United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Kentucky Natural
Resources and
Environmental Protection
Cabinet and Kentucky
Agricultural Experiment
Station

Soil Survey of Livingston County, Kentucky

How To Use This Soil Survey

General Soil Map

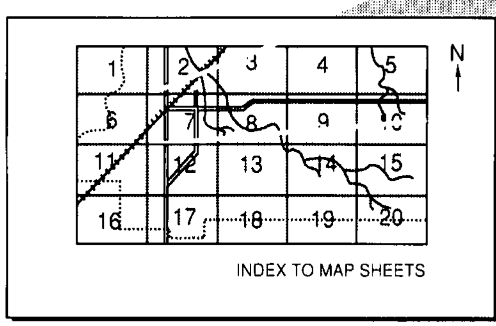
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

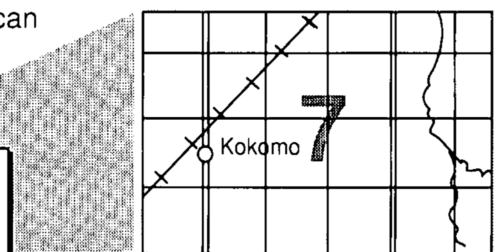
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.

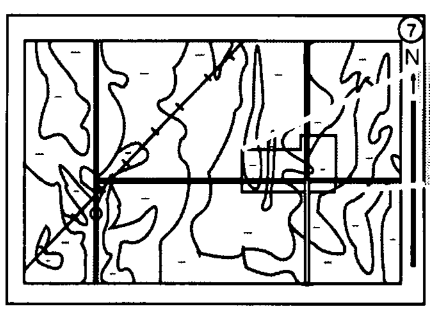


INDEX TO MAP SHEETS



MAP SHEET

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



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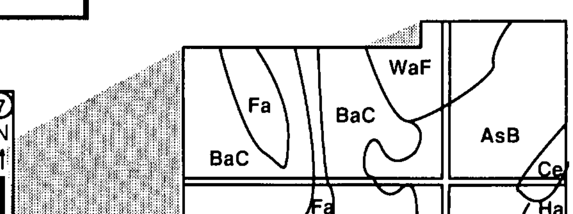

AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1988. Soil names and descriptions were approved in 1989. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1988. This soil survey was made cooperatively by the Soil Conservation Service, the Kentucky Natural Resources and Environmental Protection Cabinet, and the Kentucky Agricultural Experiment Station. It is part of the technical assistance furnished to the Livingston County Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: The confluence of the Cumberland and Ohio Rivers at Smithland. The soils on bottom land are in the Huntington-Otwell-Lindside-Wheeling general soil map unit.

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Issued September 1993

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Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Livingston County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Billy W. Milliken
State Conservationist
Soil Conservation Service

Soil Survey of
Livingston County, Kentucky

By Rudy Forsythe, Soil Conservation Service

Soils surveyed by Rudy Forsythe and Eullas H. Jacobs, Soil Conservation Service, and Kenneth E. Scott, Division of Conservation, Kentucky Natural Resources and Environmental Protection Cabinet

Map finishing by Jeanette B. Jones and Glenda C. Smith, Soil Conservation Service

Block diagrams drafted by Angela E. Craggs, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service,
in cooperation with
Kentucky Natural Resources and Environmental Protection Cabinet and Kentucky Agricultural Experiment Station

LIVINGSTON COUNTY is in the western part of Kentucky (fig. 1). It is bounded on the east by Crittenden County and Lyon County, on the south by Marshall County and McCracken County, and on the north and west by the Ohio River. Massac, Pope, and Hardin Counties lie across the river in Illinois.

Livingston County has an area of 219,085 acres, or about 342 square miles. The population is about 12,000. Smithland, the county seat, has a population of about 500. The largest community, Ledbetter, has a population of about 2,500. The elevation in the county ranges from about 302 feet above sea level along the Ohio River to about 754 feet south of Burna on Lockhart Bluff *(3)*.

Relief ranges from nearly level to very steep. Most of the nearly level soils are on the flood plains, and the gently sloping to very steep soils are on uplands. Faulting of the bedrock has been extensive in many areas.

Farming has been important to the economy of Livingston County since the early days of settlement. Corn, soybeans, wheat, and hay are the main crops. Hogs and beef cattle are the most commonly raised livestock. Dairy cattle, horses, sheep, and goats are raised on a few farms. Fluorspar mining has been of some economic importance in the county. Two local limestone quarries and coal mining in adjoining counties to the east provide jobs for county residents. Manufacturing plants to the west in the Paducah area and to the south in Calvert City also provide employment.

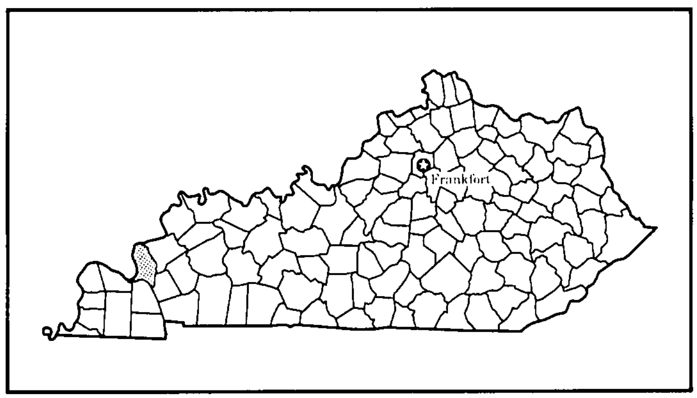

Figure 1.—Location of Livingston County in Kentucky.

General Nature of the Survey Area

This section gives general information about Livingston County. It discusses climate, history and development, relief and drainage, geology, farming, industry, and natural resources.

Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Gilbertsville Dam, Kentucky, in the period 1967 to 1987. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 38 degrees F and the average daily minimum temperature is 29 degrees. The lowest temperature on record, which occurred at Gilbertsville Dam on January 20, 1985, is -15 degrees. In summer, the average temperature is 79 degrees and the average daily maximum temperature is 90 degrees. The highest recorded temperature, which occurred at Gilbertsville Dam on July 15, 1980, is 107 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 53 inches. Of this, nearly 28 inches, or about 53 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 22 inches. The heaviest 1-day rainfall during the period of record was 8.2 inches at Gilbertsville Dam on August 31, 1982. Thunderstorms occur on about 62 days each year.

The average seasonal snowfall is about 12 inches. The greatest snow depth at any one time during the period of record was 11 inches. On an average of 3 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 65 percent of the time possible in summer and 45 percent in winter. The prevailing wind is from the south-southwest. Average windspeed is highest, 10 miles per hour, in spring.

History and Development

Livingston County was organized from Christian County in 1798 and was the 29th county created in Kentucky. It was named for Robert R. Livingston, one of the signers of the Declaration of Independence *(13)*.

The county seat was first located in Eddyville. In 1809, it was moved to Salem, where it stayed until 1842, when Smithland was established as a city and was designated the new county seat.

For many years Smithland served as a busy river port along the Ohio River. In the early years of the Civil War, the Smithland area served as a strategic point for General Grant's operations against Fort Donelson.

Grand Rivers, the northern gateway to the Land Between the Lakes recreation area, was established in the 1880's. An iron-smelting mill stimulated development.

Two hydroelectric dams are located in the county. The Kentucky Dam on the Tennessee River was completed in 1945, and the Barkley Dam on the Cumberland River was completed in 1966.

Native forests consisted mainly of upland oaks, hickory, and maple. Much of the forested land was cleared for farms and homesteads. Only about 40 percent of the land area is presently forested. Farming was the primary occupation of the early settlers.

Relief and Drainage

Relief in the county ranges from nearly level to very steep. The uplands are dominantly gently sloping to sloping but have steeper side slopes in areas adjacent to streams. The flood plains are dominantly nearly level to sloping, and in some areas they are nearly a mile wide. Most of the soils on flood plains are frequently flooded for brief periods during winter and early spring.

Surface runoff from the northern part of the county drains into the Ohio River, that from the middle part drains into the Cumberland River, and that from the southern part drains into the Cumberland River or the Tennessee River. The Cumberland River flows north from Barkley Dam to Dycusburg and then flows west and southwest and empties into the Ohio River at Smithland. The Tennessee River flows northwest, west, and southwest and empties into the Ohio River below Ledbetter.

Geology

Livingston County is in parts of two physiographic regions. These are the Western Pennyroyal region to the north of the Cumberland River and the Jackson Purchase region to the south of the river *(14)*.

The upland soils in the Western Pennyroyal area are underlain mostly by sedimentary rocks of the Mississippian System. These rocks include interbedded limestone, sandstone, and shale of the St. Genevieve Formation; interbedded limestone, shale, and chert of the St. Louis Formation; interbedded limestone, sandstone, siltstone, and shale of the Golconda Formation; interbedded sandstone, siltstone, and shale of the Cypress and Hardinsburg Formations; and sandstone of the Bethel Formation. Some of the higher areas are underlain by sedimentary rocks of the Pennsylvanian System, including interbedded sandstone, siltstone, and shale of the Caseyville Formation *(3)*.

The upland soils in the Jackson Purchase area are underlain by sedimentary rocks of the Mississippian, Cretaceous, and Tertiary Systems. Rocks of the Mississippian System include interbedded limestone, shale, and chert of the St. Louis Formation and interbedded limestone and chert of the Warsaw and Ft. Payne Formations. Rocks of the Cretaceous System include intermixed gravel, sand, silt, and clay of the McNairy and Tuscaloosa Formations. Rocks of the Tertiary System include intermixed sand, silt, clay, and gravel of the Continental Formation.

Throughout the county, soils on flood plains and terraces formed in sediments of the Quaternary System. These include intermixed silt, sand, gravel, and clay of lacustrine, fluviolacustrine, and alluvium formations and windblown, intermixed sand, silt, and clay of loess formations. The uplands are blanketed with loess deposits that vary from a few inches to several feet in thickness.

Extensive faulting occurs throughout Livingston County. As a result, the surface bedrock patterns are complex.

Farming

The sale of farm products accounts for much of the income in Livingston County. The principal crops in the survey area in 1988 were corn, soybeans, wheat, and hay *(11)*. Corn, soybeans, and wheat account for most of the income from crops. Alfalfa, red clover, lespedeza, and timothy and other legumes and grasses are harvested for hay. A considerable acreage of fescue is grown for hay and pasture.

In 1988, most of the livestock income was derived from the sale of beef cattle, swine, and dairy products. The sale of sheep and poultry generated additional income.

In 1986, according to the 1987 Census of Agriculture, Livingston County had 354 farms with an average size of 311 acres. About 46 percent of the farms ranged from 10 to 179 acres in size, and about 35 percent ranged from 180 to 499 acres.

Industry

In 1988, Livingston County residents were employed on farms and in forestry, construction, manufacturing, and mining industries. In addition to local industries, residents of the county work in manufacturing plants in Evansville, Indiana, and in Calvert City, Paducah, Madisonville, and Henderson, Kentucky, and in coal mines in nearby counties to the east.

Natural Resources

In addition to soil, the major natural resources in Livingston County are limestone, sand and gravel, fluorspar, and trees. Fluorspar was mined extensively in the county until about 1967. Large reserves of this mineral remain, but mining is not economical.

Large tracts in the steeper uplands and some areas of wet lowlands are wooded. About 79,100 acres in the county is forested *(12)*. Mixed stands of hardwoods are predominant, but several hundred acres of pine trees have been planted. A few local sawmills are in operation. A considerable volume of wood is shipped to Wickliffe to make paper.

The Cumberland, Ohio, and Tennessee Rivers are used extensively for transportation and recreation (fig. 2). Dams make the rivers navigable. The Ohio River is the source of water for Smithland and some rural areas; however, most rural residents obtain water from cisterns, wells, or springs. Ponds and lakes are used for watering livestock, for fishing, for swimming, and for home supply.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material from which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been

Figure 2.—Recreation and commerce on the Ohio River. Huntington silt loam, frequently flooded, is in the background.

changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area are generally collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by two or three kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. In the detailed soil map units, these latter soils are called inclusions or included soils. In the general soil map units, they are called soils of minor extent.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soils on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or a building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

1. Huntington-Otwell-Lindside-Wheeling

Very deep, nearly level to very steep, well drained and moderately well drained soils that have a loamy subsoil; on flood plains and stream terraces

This map unit occurs throughout Livingston County along the Cumberland, Ohio, and Tennessee Rivers and their tributaries. The landscape is characterized by nearly level alluvial soils that border the rivers and major streams and are separated from the broad, nearly level to sloping terraces by short, sloping to moderately steep side slopes (fig. 3). Slopes range from 0 to 55 percent but are dominantly 0 to 6 percent on the terraces and flood plains and 12 to 20 percent on the terrace side slopes. A few creeks or perennial streams and many intermittent streams drain into the major rivers. Urban and farm structures, roads, and electric power lines are the major structures. The cities of Ledbetter and Smithland are in this unit.

This map unit makes up about 23 percent of the county. It is about 26 percent Huntington and similar soils, 21 percent Otwell and similar soils, 19 percent Lindside and similar soils, 14 percent Wheeling and similar soils, and 20 percent soils of minor extent.

Huntington soils are on nearly level flood plains along the rivers. They also occur in nearly level to moderately steep areas along river banks and on terrace side slopes. They are well drained. They formed in mixed alluvium. Typically, the surface layer is dark brown silt loam. The subsoil is dark grayish brown and brown silt loam. The substratum is brown, stratified silt loam, loam, and fine sand.

Otwell soils are on gently sloping to sloping, long, broad stream terraces. They are moderately well drained. They formed in mixed alluvium. Typically, the surface layer is silt loam. The upper part of the subsoil is strong brown silt loam and silty clay loam. The lower part is a firm, compact, brittle fragipan of yellowish brown and brown, mottled silt loam and silty clay loam. The substratum is brown, mottled silt loam.

Lindside soils are on nearly level flood plains along the rivers and major streams. They are moderately well drained. They formed in mixed alluvium. Typically, the surface layer is brown silt loam. The subsoil is dark yellowish brown and brown, mottled silt loam. The substratum is grayish brown silty clay loam and gray, mottled, stratified silty clay loam, loam, and silt loam.

Wheeling soils are on nearly level to sloping stream terraces and, to a lesser extent, on narrow, moderately steep to very steep stream terrace banks and river banks. They are well drained. They formed in mixed alluvium. Typically, the surface layer is brown silt loam. The subsoil is strong brown silt loam in the upper part and strong brown loam in the lower part. The substratum is strong brown loam in the upper part and stratified loam and sandy loam in the lower part.

For the purpose of naming this map unit, similar soils were grouped together. Those similar to the Huntington soils include Ashton, Nelse, and Nolin soils; those similar to the Otwell soils include Henshaw soils; those similar to the Lindside soils include Newark soils; and those similar to the Wheeling soils include Elk and Chavies soils.

Of minor extent in this map unit are Dunning, Karnak, and Melvin soils on flood plains and Licking, McGary, and Peoga soils on stream terraces.

Most of the acreage in this map unit is used for row

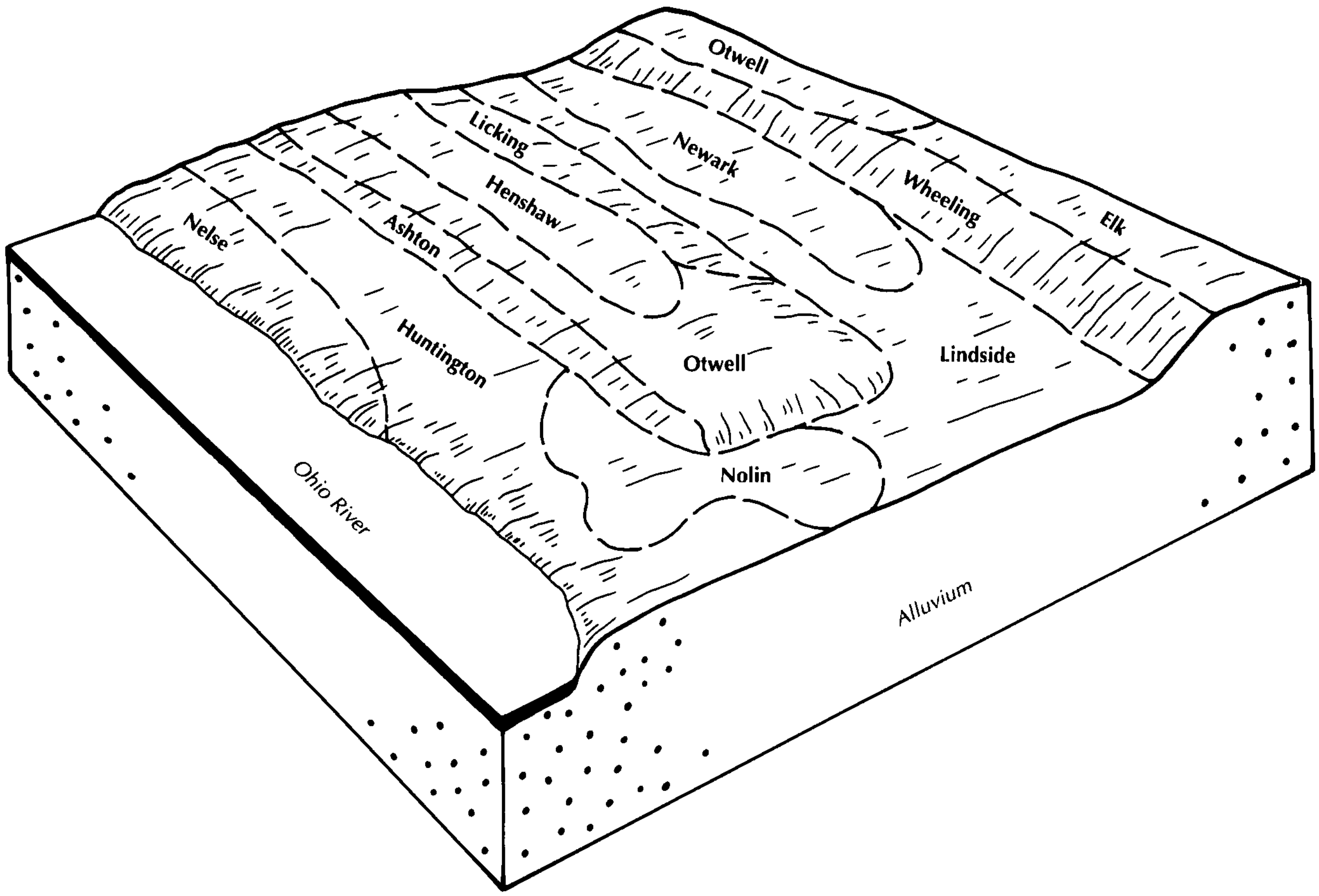

Figure 3.—Relationship of soils to topography and underlying material in the Huntington-Otwell-Lindside-Wheeling general soil map unit.

crops, hay and pasture, or urban development. The steepest areas are generally wooded.

This map unit is well suited to farming. The nearly level to sloping soils are well suited to the row crops commonly grown in the county. The soils in the steeper areas are better suited to hay, pasture, and woodland than to row crops. The main limitations are wetness, flooding, the hazard of erosion, and the slope.

This map unit is well suited to woodland. The equipment limitation, seedling mortality, and plant competition are management concerns.

Most of this map unit is suited to urban development. The flooding, the wetness, slow permeability, and the slope are the main limitations affecting residential and other urban uses. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soils are used as a source of roadfill.

This map unit is well suited to woodland wildlife habitat.

2. Zanesville-Loring-Frondorf

Very deep and moderately deep, gently sloping to very steep, moderately well drained and well drained soils that have a loamy subsoil; on upland ridgetops and side slopes

This map unit is dominantly in the central and northern parts of Livingston County. The landscape is characterized by broad upland ridges that have been dissected by a dendritic drainage system to form a series of low hills and narrow valleys (fig. 4). Slopes range from 2 to 50 percent. The major soils formed in loess or in loess and material weathered from sandstone, siltstone, or shale. Urban and farm structures, roads, and electric power lines are the major structures in this unit.

This map unit makes up about 42 percent of the county. It is about 35 percent Zanesville soils, 27 percent Loring soils, 16 percent Frondorf soils, and 22 percent soils of minor extent.

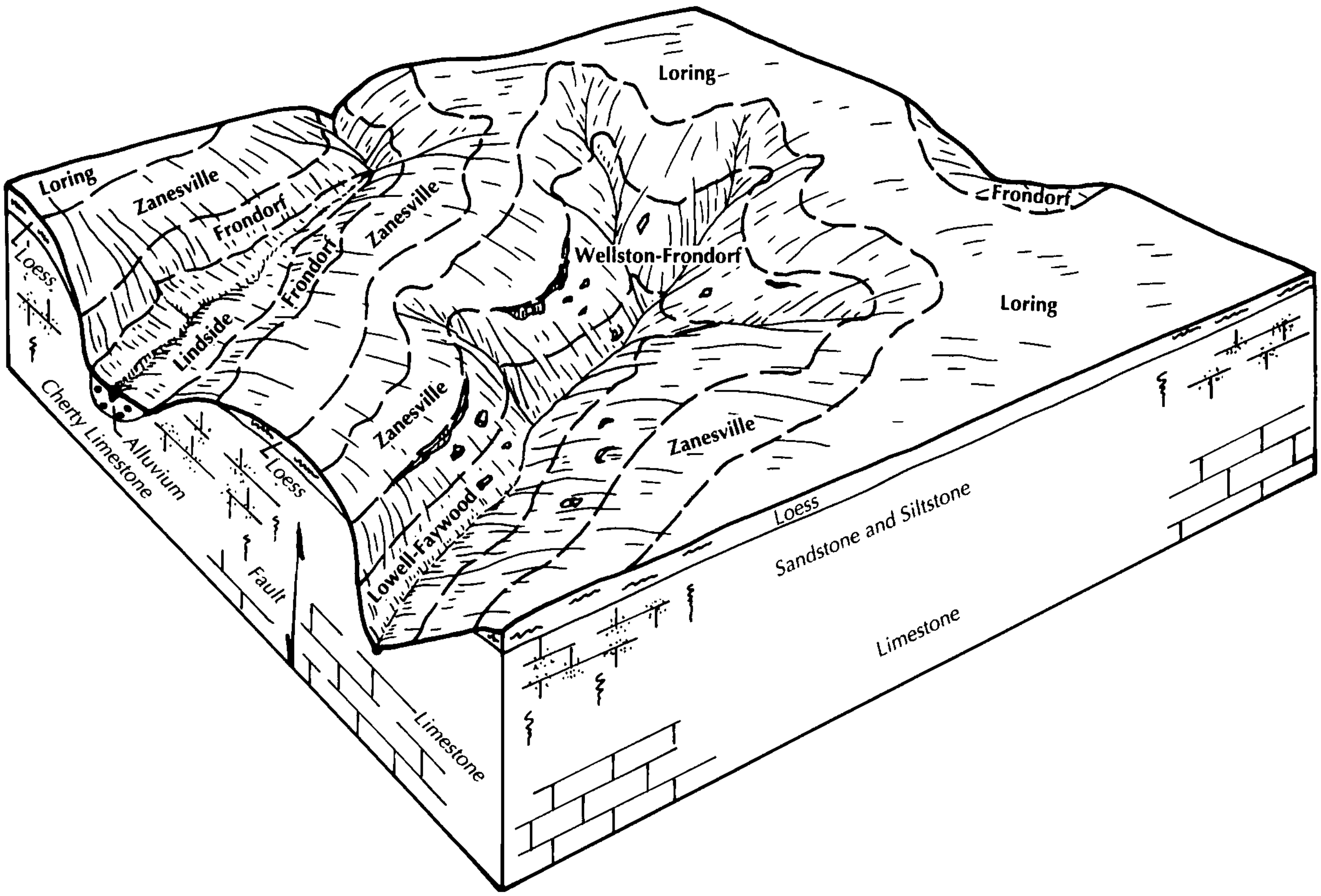

Figure 4.—Relationship of soils to topography and underlying material in the Zanesville-Loring-Frondorf general soil map unit.

Zanesville soils are on the sloping and moderately steep upper side slopes in the uplands. They are very deep and moderately well drained. They formed in a silty mantle over material weathered from sandstone and shale. Typically, the surface layer is brown silt loam. The upper part of the subsoil is brown silt loam and strong brown silty clay loam. The next part is a firm, compact, brittle fragipan of brown, mottled silt loam. The lower part is strong brown, mottled silt loam. The substratum is strong brown and brown, mottled silt loam.

Loring soils are on gently sloping and sloping, broad ridgetops and the moderately steep upper side slopes in the uplands. They are very deep and moderately well drained. They formed in loess. Typically, the surface layer is brown silt loam. The upper part of the subsoil is strong brown silt loam. The lower part is a firm, compact, brittle fragipan of strong brown and brown, mottled silt loam. The substratum is strong brown silt loam.

Frondorf soils are on moderately steep to very steep side slopes in the uplands. In a few areas they have rock outcrops in the form of sandstone cliffs. The soils are moderately deep and well drained. They formed in a silty mantle of loess and colluvium over material weathered from sandstone, siltstone, or shale. Typically, the surface layer is dark brown silt loam. The subsurface layer is yellowish brown gravelly silt loam. The upper part of the subsoil is yellowish brown silt loam and silty clay loam. The lower part is strong brown gravelly silt loam and very channery silty clay loam.

Of minor extent in this map unit are Baxter, Brandon, Faywood, Hammack, Lowell, Memphis, Nicholson, Saffell, and Wellston soils on upland ridgetops and side slopes; Elk, Henshaw, Licking, McGary, Otwell, and Wheeling soils on stream terraces; and Huntington, Lindside, Nelse, Newark, and Nolin soils on flood plains.

Most of the acreage in this map unit is used for row crops, hay and pasture, or urban development. The

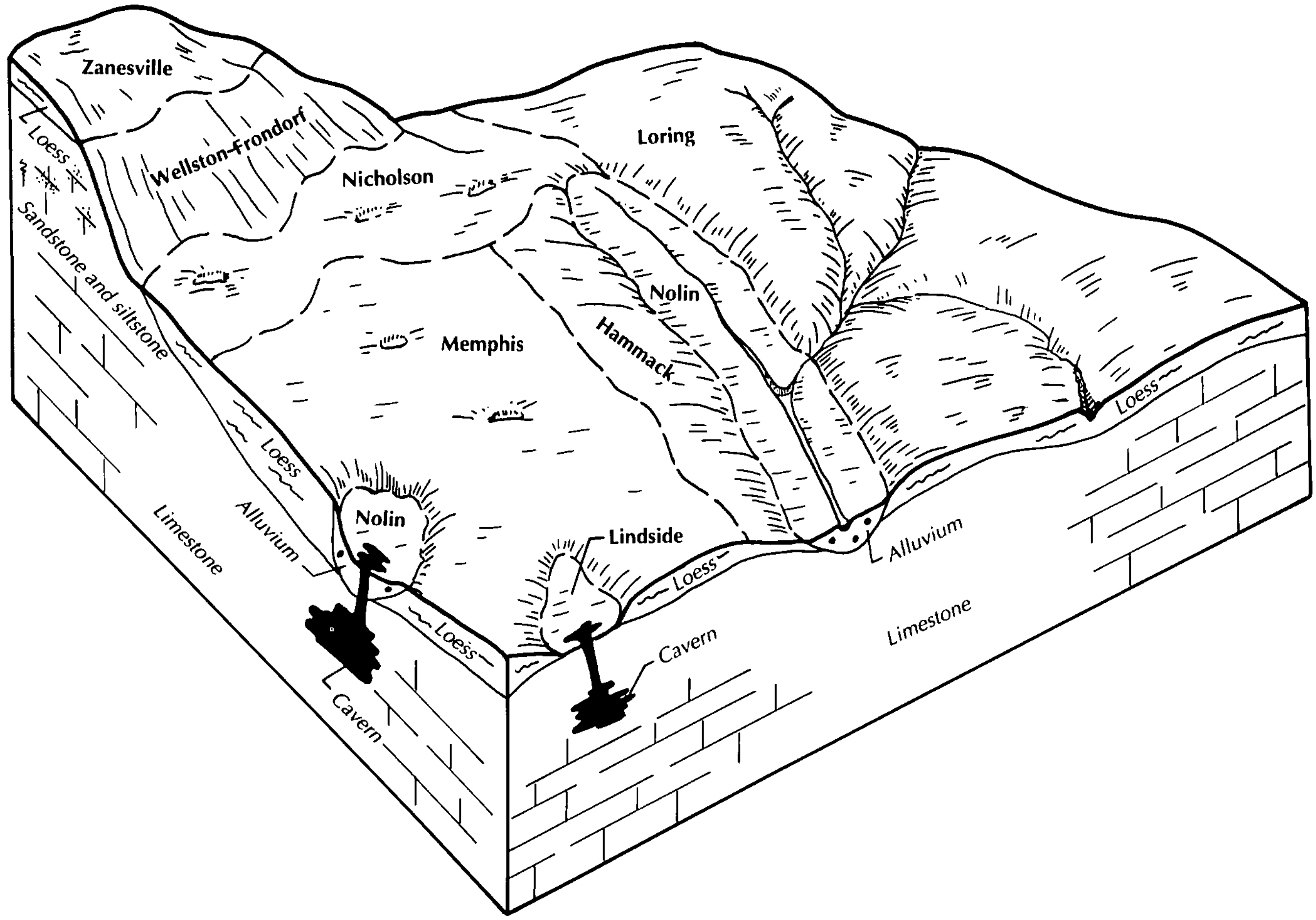

Figure 5.—Relationship of soils to topography and underlying material in the Loring-Memphis-Nicholson general soil map unit.

steepest areas are generally wooded.

This map unit is suited to farming. The gently sloping and sloping soils are well suited to the row crops commonly grown in the county. The soils in the steeper areas are better suited to hay, pasture, and woodland than to row crops. The main limitations are the hazard of erosion, the slope, and a moderately deep root zone.

This map unit is well suited to woodland. The erosion hazard, the equipment limitation, seedling mortality, and plant competition are management concerns.

Most of this map unit is suited to urban development. The slope, wetness, the depth to bedrock, and slow permeability are the main limitations affecting residential and other urban uses. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soils are used as a source of roadfill.

This map unit is well suited to woodland wildlife habitat.

3. Loring-Memphis-Nicholson

Very deep, gently sloping to steep, moderately well drained and well drained soils that have a loamy subsoil; on upland ridgetops and side slopes

This map unit is dominantly in the eastern part of Livingston County, north of the Cumberland River. The landscape is characterized by upland ridges and valleys that have been formed by a dendritic drainage system (fig. 5). Slopes range from 2 to 30 percent. The major soils formed in loess or in loess and the underlying material weathered from limestone. Karst topography and sinkholes are common in this map unit. Urban and farm structures, roads, and electric power lines are the major structures in this unit.

This map unit makes up about 10 percent of the county. It is about 30 percent Loring soils, 23 percent

Memphis soils, 10 percent Nicholson soils, and 37 percent soils of minor extent.

Loring soils are on gently sloping and sloping, broad ridgetops and moderately steep side slopes. They are moderately well drained. They formed in loess. Typically, the surface layer is brown silt loam. The upper part of the subsoil is strong brown silt loam. The lower part is a firm, compact, brittle fragipan of strong brown and brown, mottled silt loam. The substratum is strong brown silt loam.

Memphis soils are on gently sloping to steep, broad uplands and side slopes. They are well drained. They formed in loess. Typically, the surface layer is dark yellowish brown silt loam. The subsoil is strong brown and brown silt loam. The substratum is brown silt loam.

Nicholson soils are on gently sloping to moderately steep, broad ridgetops and the upper side slopes. They are moderately well drained. They formed in a silty mantle over material weathered from limestone. Typically, the surface layer is yellowish brown silt loam. The upper part of the subsoil also is yellowish brown silt loam. The next part is a firm, compact, brittle fragipan of yellowish brown, mottled silt loam. The lower part is red, mottled silty clay loam. The substratum is red silty clay.

Of minor extent in this map unit are Baxter, Faywood, Frondorf, Hammack, Lowell, Wellston, and Zanesville soils on upland ridgetops and side slopes; Elk, McGary, and Otwell soils on stream terraces; and Dunning, Lindside, Melvin, Newark, and Nolin soils on flood plains.

Most of the acreage in this map unit is used for row crops or for hay and pasture. The steeper areas are generally wooded.

This map unit is suited to farming. The gently sloping and sloping soils are well suited to the row crops commonly grown in the county. The soils in the steeper areas are better suited to hay, pasture, and woodland than to row crops. The main limitations are the hazard of erosion, the slope, and a moderately deep root zone.

This map unit is well suited to woodland. The erosion hazard, the equipment limitation, seedling mortality, and plant competition are management concerns.

Most of this map unit is suited to urban development. The slope, wetness, and slow permeability are the main limitations affecting residential and other urban uses. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soils are used as a source of roadfill.

This map unit is well suited to woodland wildlife habitat.

4. Baxter-Hammack-Loring

Very deep, gently sloping to very steep, well drained and moderately well drained soils that have a clayey or loamy subsoil; on upland ridgetops and side slopes

This map unit is in the central part of Livingston County. The landscape is characterized by upland ridges and valleys that have been formed by a dendritic drainage system (fig. 6). Slopes range from 2 to 50 percent. Sinkholes are in some areas. Farm structures, dwellings, roads, and electric power lines are the major structures in this unit.

This unit makes up about 12 percent of Livingston County. It is about 29 percent Baxter soils, 23 percent Hammack soils, 20 percent Loring soils, and 28 percent soils of minor extent.

Baxter soils are on steep or very steep side slopes. They are well drained. They formed in material weathered from cherty limestone. Typically, the surface layer is yellowish brown gravelly silt loam. The upper part of the subsoil also is yellowish brown gravelly silt loam. The next part is red very gravelly silty clay loam or gravelly silty clay. The lower part is red, mottled gravelly clay.

Hammack soils are on sloping to moderately steep ridgetops and the upper side slopes. They are well drained. They formed in a silty mantle over material weathered from cherty limestone. Typically, the surface layer is yellowish brown silt loam. The upper part of the subsoil is brown silty clay loam. The next part is brown extremely gravelly silty clay loam. The lower part is yellowish red clay, reddish brown gravelly clay, and reddish brown very gravelly clay.

Loring soils are on gently sloping and sloping ridgetops and the moderately steep upper side slopes. They are moderately well drained. They formed in loess. Typically, the surface layer is brown silt loam. The upper part of the subsoil is strong brown silt loam. The lower part is a firm, compact, brittle fragipan of strong brown and brown, mottled silt loam. The substratum is strong brown silt loam.

Of minor extent in this map unit are Brandon, Faywood, Frondorf, Lowell, Memphis, Nicholson, Saffell, Wellston, and Zanesville soils on upland ridgetops and side slopes; Elk, McGary, and Otwell soils on stream terraces; and Dunning, Lindside, Melvin, Newark, and Nolin soils on flood plains.

Most of the acreage in this map unit is used for row crops or for hay and pasture. The steeper areas are generally wooded.

This map unit is suited to farming. The gently sloping

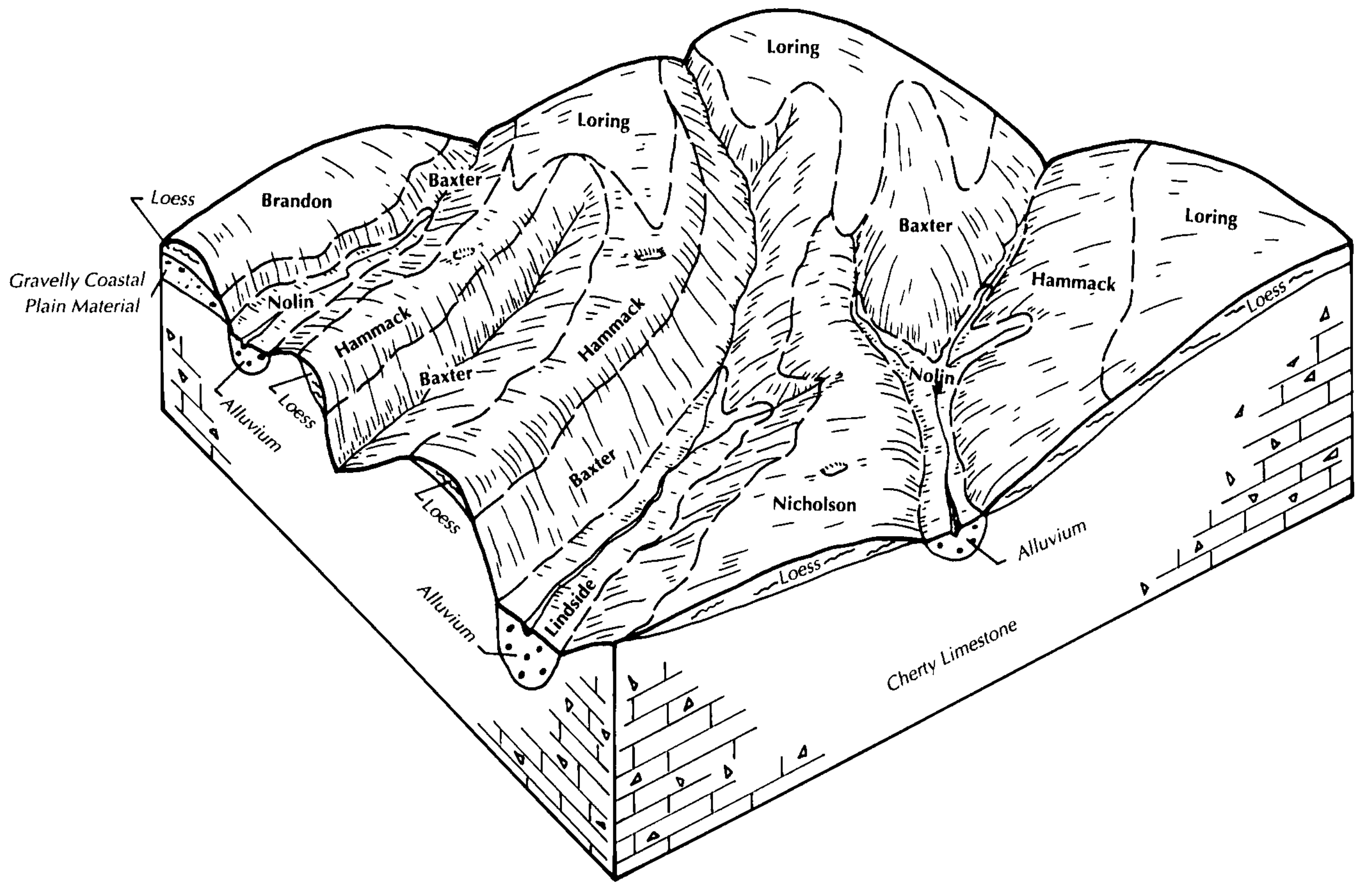

Figure 6.—Relationship of soils to topography and underlying material in the Baxter-Hammack-Loring general soil map unit.

and sloping soils are well suited to the row crops commonly grown in the county. The soils in the steeper areas are better suited to hay, pasture, and woodland than to row crops. The main limitations are the hazard of erosion, the slope, and a moderately deep root zone.

This map unit is well suited to woodland. The erosion hazard, the equipment limitation, seedling mortality, and plant competition are management concerns.

This map unit is poorly suited to urban development. The slope, the clayey subsoil, wetness, and slow permeability are the main limitations affecting residential and other urban uses. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soils are used as a source of roadfill.

This map unit is well suited to woodland wildlife habitat.

5. Loring-Brandon-Saffell

Very deep, gently sloping to very steep, moderately well drained and well drained soils that have a loamy subsoil; on upland ridgetops and side slopes

This map unit is in the southeastern part of Livingston County. The landscape is characterized by upland ridges and valleys that have been formed by a dendritic drainage system (fig. 7). Slopes range from 2 to 40 percent. Urban and farm structures, dwellings, roads, and electric power lines are the major structures in this unit.

This unit makes up about 13 percent of the county. It is about 37 percent Loring soils, 31 percent Brandon soils, 9 percent Saffell soils, and 23 percent soils of minor extent.

Loring soils are on gently sloping to moderately steep

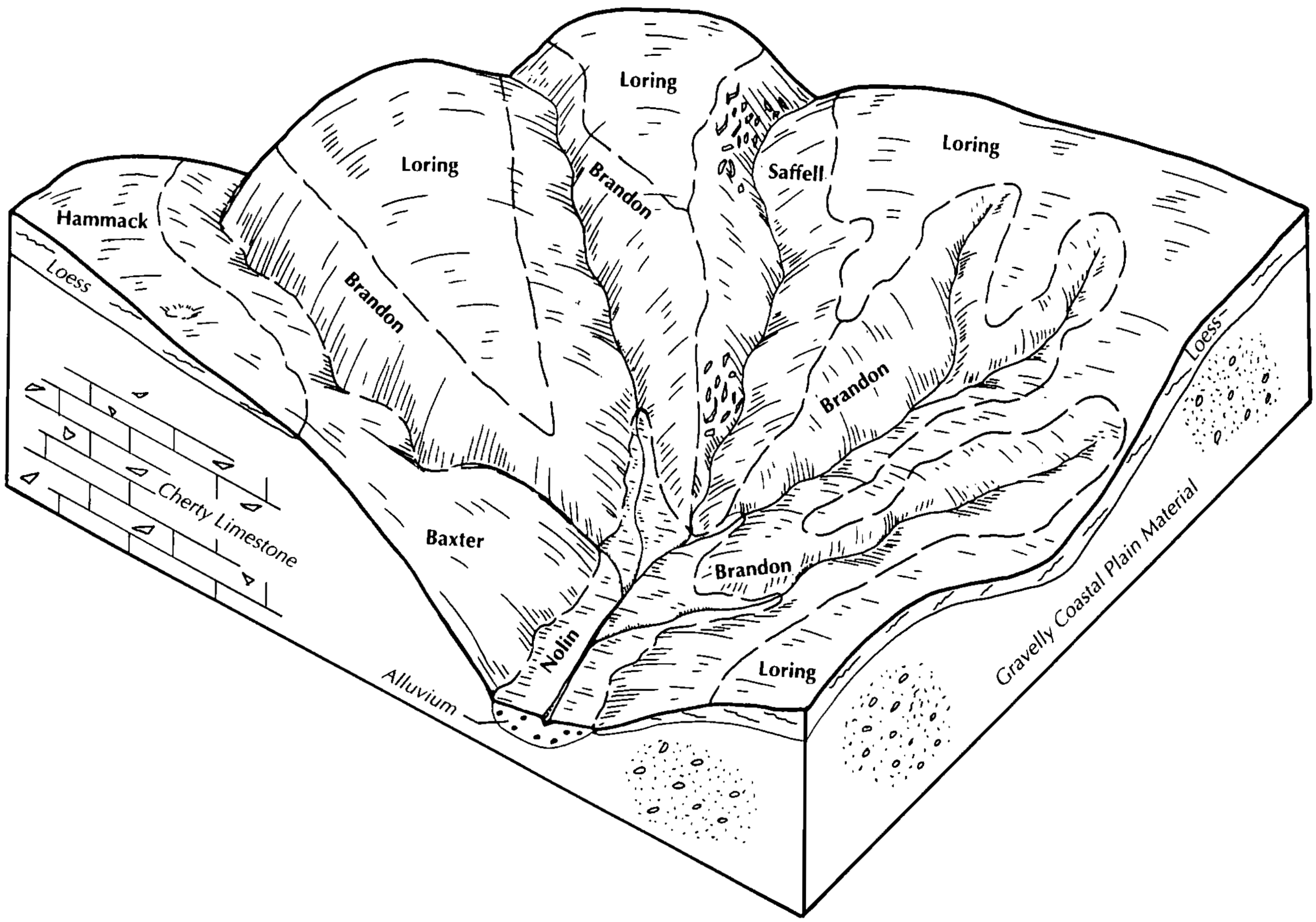

Figure 7.—Relationship of soils to topography and underlying material in the Loring-Brandon-Saffell general soil map unit.

ridgetops and the upper side slopes. They are moderately well drained. They formed in loess. Typically, the surface layer is brown silt loam. The upper part of the subsoil is strong brown silt loam. The lower part is a firm, compact, brittle fragipan of strong brown and brown, mottled silt loam. The substratum is strong brown silt loam.

Brandon soils are on sloping to moderately steep ridgetops and side slopes. They are well drained. They formed in a silty mantle over gravelly Coastal Plain material. Typically, the surface layer is brown silt loam. The upper part of the subsoil is yellowish brown silt loam. The next part is strong brown silty clay loam. The lower part is strong brown silt loam. The substratum is brown very gravelly silt loam.

Saffell soils are on steep to very steep side slopes. They are well drained. They formed in gravelly Coastal Plain material. Typically, the surface layer is brown gravelly silt loam. The upper part of the subsoil is yellowish brown very gravelly silt loam. The next part is strong brown extremely gravelly clay loam and extremely gravelly sandy clay loam. The lower part is yellowish red, mottled extremely gravelly sandy clay loam. The substratum is yellowish red extremely gravelly sandy loam.

Of minor extent in this unit are Baxter, Hammack, and Zanesville soils on upland ridgetops and side slopes; McGary and Wheeling soils on stream terraces; and Lindside, Newark, and Nolin soils on flood plains.

Most of the acreage in this map unit is used for hay, pasture, or row crops or for urban development. The steeper areas are generally wooded.

This unit is suited to farming. The gently sloping and sloping soils are well suited to the row crops commonly grown in the county. The soils in the steeper areas are better suited to hay, pasture, and woodland than to row crops. The main limitations are the hazard of erosion, the slope, and a moderately deep root zone.

This map unit is well suited to woodland, and productivity is high or moderately high. The erosion hazard, the equipment limitation, seedling mortality, and plant competition are management concerns.

This map unit is poorly suited to urban development. The slope, wetness, slow permeability, and the high content of gravel are the main limitations affecting residential and other urban uses.

This map unit is well suited to woodland wildlife habitat.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Memphis silt loam, 2 to 6 percent slopes, is a phase of the Memphis series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Wellston-Frondorf silt loams, very rocky, 20 to 50 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, quarries, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The "Glossary" defines many of the terms used in describing the soils.

AsA—Ashton silt loam, 0 to 4 percent slopes, occasionally flooded. This very deep, well drained soil is nearly level and gently sloping. It is on low stream terraces along the Cumberland, Ohio, and Tennessee Rivers. Individual areas range from about 4 to 374 acres in size.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsoil is silty clay loam. The upper part is dark brown or brown. The next part is dark yellowish brown. The lower part to a depth of about 60 inches is strong brown.

This soil is high in natural fertility and moderate in organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is only fair because of past intensive cultivation. The soil can be cultivated within only a narrow range in moisture content. The root zone is very deep and can be easily penetrated by plant roots. The soil is occasionally flooded for very brief periods.

Included with this soil in mapping are small areas of Elk, Huntington, Lindside, and Nolin soils. Elk soils are in landscape positions similar to those of the Ashton soil. Also included are areas that have short, sloping or moderately steep slopes and small areas of soils that are similar to the Ashton soil but have a surface layer of silty clay loam and are moderately well drained. Included areas make up less than 10 percent of this map unit. They are less than 2 acres in size.

Most areas of the Ashton soil are used for row crops, such as grain sorghum, corn, and soybeans. A few areas are wooded.

This soil is suited to row crops. It has been cropped intensively. Because of past surface compaction, the surface layer has poor structure and tilth is only fair. Tilth can be improved by implementing crop residue management techniques, tilling under proper moisture conditions, and including grasses and legumes in the cropping sequence. The flooding is a concern if winter crops are grown.

This soil is well suited to hay and pasture. Applications of fertilizer and lime, control of weeds and brush, and rotation grazing are suitable management practices. Hay crops may be damaged by the flooding.

This soil is well suited to woodland, but few areas are used for the production of timber. Species preferred for planting include eastern white pine, yellow poplar, black walnut, sweetgum, cherrybark oak, eastern cottonwood, and white ash. The main management concerns are seedling mortality and plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is poorly suited to most urban uses because of the hazard of flooding. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IIw.

BaE—Baxter gravelly silt loam, 20 to 50 percent slopes. This very deep, well drained, steep or very steep, gravelly soil is on upland side slopes in the southern part of the county. Some areas are dissected by intermittent drains. Individual areas range from about 3 to 666 acres in size.

Typically, the surface layer is yellowish brown gravelly silt loam about 8 inches thick. The subsoil extends to a depth of about 64 inches. The upper part is yellowish brown gravelly silt loam. The next part is red very gravelly silty clay loam or gravelly silty clay. The lower part is red, mottled gravelly clay.

This soil is medium in natural fertility and moderate in organic matter content. The root zone is very deep, permeability is moderate, and the available water capacity is high. The shrink-swell potential is moderate in the clayey subsoil.

Included with this soil in mapping are small areas of Brandon, Hammack, Loring, and Saffell soils. These soils are in landscape positions similar to those of the Baxter soil. Also included are some soils that have more than 35 percent gravel and some areas of severely eroded soils. Included areas make up less than 20 percent of this map unit. They are generally less than 3 acres in size.

Most areas of the Baxter soil are wooded. Some areas are used for pasture.

This soil is suited to pasture. The slope is the main limitation. Maintaining good stands of grasses and legumes and maintaining a high fertility level can help to control erosion in areas used for pasture.

This soil is suited to woodland. Upland oaks, hickory, and maple are the dominant native trees. Species preferred for planting include yellow poplar, eastern white pine, shortleaf pine, white ash, white oak, northern red oak, and loblolly pine. Management concerns include the hazard of erosion, the equipment limitation, and plant competition. Steep skid trails or roads are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. The slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and results in less disturbance of the surface layer. Competition from undesirable plants can hinder natural or artificial reforestation. Intensive site preparation and maintenance may be needed. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for woodland wildlife.

This soil is poorly suited to most urban uses. The slope is the main limitation. The high content of clay also is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill.

This soil is in capability subclass VIIe.

BrC—Brandon silt loam, 6 to 12 percent slopes. This very deep, well drained, sloping soil is on upland ridgetops and side slopes, mainly in the southeastern part of the county. Individual areas range from about 3 to 69 acres in size.

Typically, the surface layer is brown silt loam about 6 inches thick. The subsoil extends to a depth of about 34 inches. It is yellowish brown silt loam in the upper part, strong brown silty clay loam in the next part, and strong brown silt loam in the lower part. The substratum to a depth of about 60 inches is brown very gravelly sandy clay loam.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate in the subsoil and moderately rapid or rapid in the substratum. The available water capacity is high. Tilth is good. The soil can be cultivated throughout a wide range in moisture content. The root zone is very deep and can be easily penetrated by plant roots, but the substratum has little available plant food or water.

Included with this soil in mapping are small areas of Baxter, Hammack, Loring, and Saffell soils. Hammack and Loring soils are in landscape positions similar to those of the Brandon soil. Baxter and Saffell soils are on the lower, steeper side slopes. Included areas make up less than 10 percent of this map unit. They are less than 3 acres in size.

Most areas of the Brandon soil are used for pasture. Some areas are wooded.

This soil is suited to most row crops. The hazard of erosion is severe if conventional tillage methods are used. Measures that control erosion and runoff include conservation tillage, cover crops, crop residue management, and a cropping sequence that includes grasses and legumes.

This soil is suited to hay and pasture. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and weed control help to maintain the desired plants.

This soil is suited to woodland. Species preferred for planting include eastern white pine, loblolly pine, shortleaf pine, northern red oak, and white oak. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is suited to most urban uses. The slope is a limitation affecting building site development and sanitary facilities. Seepage also is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IIIe.

BrC3—Brandon silt loam, 6 to 12 percent slopes, severely eroded. This very deep, well drained, sloping soil is on upland ridgetops and side slopes, mainly in the southeastern part of the county. Individual areas range from about 4 to 164 acres in size. Erosion has removed most of the original surface layer and in some places has removed some of the subsoil. Some areas have rills and shallow gullies.

Typically, the surface layer is brown silt loam about 5 inches thick. The subsoil extends to a depth of about 36 inches. It is yellowish brown silt loam in the upper part, strong brown silty clay loam in the next part, and strong brown silt loam in the lower part. The substratum to a depth of about 60 inches is brown very gravelly silt loam.

This soil is low in natural fertility and organic matter content. Permeability is moderate in the subsoil and moderately rapid or rapid in the substratum. The available water capacity is high. Tilth is fair. The soil crusts and becomes cloddy if cultivated when the moisture content is too high. The root zone is very deep and can be easily penetrated by plant roots, but the substratum has little available plant food or water.

Included with this soil in mapping are small areas of Baxter, Hammack, Loring, and Saffell soils. Hammack and Loring soils are in landscape positions similar to those of the Brandon soil. Baxter and Saffell soils are on the lower, steeper side slopes. Included areas make up less than 10 percent of this map unit. They are less than 3 acres in size.

Most areas of the Brandon soil are used for pasture. Some areas are wooded.

This soil is poorly suited to row crops because of damage from past erosion. The hazard of erosion is very severe if conventional tillage methods are used. Practices that slow surface runoff, help to control erosion, improve soil tilth, and maintain crop yields include conservation tillage, contour farming, stripcropping, water disposal systems, crop residue management, cover crops, a cropping sequence that includes grasses and legumes, and applications of fertilizer and lime.

This soil is suited to hay and pasture. Establishing vegetation is somewhat difficult because erosion has removed most of the original surface layer. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and weed control help to maintain the desired plants.

This soil is suited to woodland. Species preferred for planting include eastern white pine, loblolly pine, shortleaf pine, northern red oak, and white oak. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is suited to most urban uses. The slope is a limitation affecting building site development and sanitary facilities. Seepage also is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IVe.

BrD—Brandon silt loam, 12 to 20 percent slopes. This very deep, well drained, moderately steep soil is on upland side slopes, mainly in the southeastern part of the county. Individual areas range from about 3 to 257 acres in size.

Typically, the surface layer is brown silt loam about 6 inches thick. The subsoil extends to a depth of about 34 inches. It is yellowish brown silt loam in the upper part, strong brown silty clay loam in the next part, and strong brown silt loam in the lower part. The substratum to a depth of about 60 inches is brown very gravelly sandy clay loam.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate in the subsoil and moderately rapid or rapid in the substratum. The available water capacity is high. Tilth is good. The soil can be cultivated throughout a wide range in moisture content. The root zone is very deep and can be easily penetrated by plant roots, but the substratum has little available plant food or water.

Included with this soil in mapping are small areas of Baxter, Hammack, Loring, and Saffell soils. Hammack and Loring soils are in landscape positions similar to those of the Brandon soil. Baxter and Saffell soils are on the lower, steeper side slopes. Included areas make up 10 to 15 percent of this map unit. They are less than 3 acres in size.

Most areas of the Brandon soil are wooded. Some areas are used for hay and pasture.

This soil is poorly suited to row crops. The hazard of erosion is very severe if conventional tillage methods are used. Conservation tillage and contour farming help to control runoff and erosion.

This soil is suited to hay and pasture. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and weed control help to maintain the desired plants.

This soil is suited to woodland. Upland oaks and hickory are the dominant native trees. Species preferred for planting include loblolly pine, shortleaf pine, and white oak. Management concerns on both cool and warm aspects of this soil include the hazard of erosion, the equipment limitation, and plant competition. Seedling mortality is an additional management concern on warm aspects. Steep skid trails or roads are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. The slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and results in less disturbance of the surface layer. Competition from undesirable plants can hinder natural or artificial reforestation. Intensive site preparation and maintenance may be needed. See table 7 for specific information relating to potential productivity and appropriate trees to plant on warm and cool aspects of this soil.

This soil is well suited to habitat for woodland wildlife.

This soil is poorly suited to most urban uses. The slope is a limitation affecting building site development and sanitary facilities. Seepage also is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IVe.

BrD3—Brandon silt loam, 12 to 20 percent slopes, severely eroded. This very deep, well drained, moderately steep soil is on upland side slopes, mainly in the southeastern part of the county. Individual areas range from about 3 to 194 acres in size. Erosion has removed most of the original surface layer and in places has removed some of the subsoil. Some areas have rills and shallow gullies.

Typically, the surface layer is brown silt loam about 5 inches thick. The subsoil extends to a depth of about 36 inches. It is yellowish brown silt loam in the upper part, strong brown silty clay loam in the next part, and strong brown silt loam in the lower part. The substratum to a depth of about 60 inches is brown very gravelly silt loam.

This soil is low in natural fertility and organic matter content. Permeability is moderate in the subsoil and moderately rapid or rapid in the substratum. Tilth is fair. The soil crusts and becomes cloddy if cultivated when the moisture content is too high. The available water capacity is high. The root zone is very deep and can be easily penetrated by plant roots, but the substratum has little available plant food or water.

Included with this soil in mapping are small areas of Baxter and Saffell soils. These soils are in landscape positions similar to those of the Brandon soil. Included areas make up 10 to 15 percent of this map unit. They are less than 3 acres in size.

Most areas of the Brandon soil are wooded. Some areas are used for hay and pasture. A few areas have been abandoned and support bushes, briers, and broomsedge.

This soil is poorly suited to row crops because of damage from past erosion.

This soil is suited to hay and pasture. Establishing vegetation is somewhat difficult because erosion has removed most of the original surface layer. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and weed control help to maintain the desired plants.

This soil is suited to woodland. Upland oaks and hickory are the dominant native trees. Species preferred for planting include loblolly pine, shortleaf pine, and white oak. Management concerns on both cool and warm aspects of this soil include the hazard of erosion, the equipment limitation, and plant competition. Seedling mortality is an additional management concern on warm aspects. Steep skid trails or roads are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. The slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and results in less disturbance of the surface layer. Competition from undesirable plants can hinder adequate natural or artificial reforestation. Intensive site preparation and maintenance may be needed. See table 7 for specific information relating to potential productivity and appropriate trees to plant on warm and cool aspects of this soil.

This soil is well suited to habitat for woodland wildlife.

This soil is poorly suited to most urban uses. The slope is a limitation affecting building site development and sanitary facilities. Seepage also is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass VIe.

ChB—Chavies fine sandy loam, 2 to 6 percent slopes. This very deep, well drained, gently sloping soil is on stream terraces along the Cumberland, Ohio, and Tennessee Rivers. Individual areas range from about 4 to 48 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 14 inches thick. The subsoil extends to a depth of about 60 inches. It is yellowish brown fine sandy loam in the upper part and strong brown loam in the lower part.

This soil is medium in natural fertility and moderate in organic matter content. The available water capacity is high, and permeability is moderately rapid. The soil can be easily tilled throughout a wide range in moisture content. The root zone is very deep and can be easily penetrated by plant roots.

Included with this soil in mapping are small areas of Elk and Wheeling soils. These soils are in landscape positions similar to those of the Chavies soil. Also included are small areas of soils that have more sand throughout the profile than the Chavies soil. Included areas make up less than 10 percent of this map unit. They are less than 2 acres in size.

Most areas of the Chavies soil are used extensively for row and garden crops. Because this soil has good natural drainage and warms up early in the spring, it is well suited to many vegetable crops and orchard and nursery plants.

This soil is well suited to all of the row crops commonly grown in the area. The hazard of erosion is moderate. Applying a system of conservation tillage, implementing crop residue management techniques, growing cover crops, and including grasses and legumes in the cropping sequence help to control erosion and maintain good tilth and organic matter content.

This soil is well suited to the pasture and hay plants commonly grown in the area. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and weed control help to maintain the desired species.

This soil is suited to woodland. Species preferred for planting include yellow poplar, eastern white pine, black walnut, northern red oak, white oak, shortleaf pine, and loblolly pine. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is well suited to most urban uses. Seepage is a limitation on sites for most kinds of sanitary facilities.

This soil is in capability subclass IIe.

ChD—Chavies fine sandy loam, 6 to 20 percent slopes. This very deep, well drained, sloping or moderately steep soil is on stream terraces along the Cumberland, Ohio, and Tennessee Rivers. Individual areas range from about 3 to 138 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 14 inches thick. The subsoil extends to a depth of about 60 inches. It is yellowish brown fine sandy loam in the upper part and strong brown loam in the lower part.

This soil is medium in natural fertility and moderate in organic matter content. The available water capacity is high, and permeability is moderately rapid. The soil can be easily tilled throughout a wide range in moisture content. The root zone is very deep.

Included with this soil in mapping are small areas of Elk and Wheeling soils. These soils are in landscape positions similar to those of the Chavies soil. Also included are small areas of soils that have more sand throughout the profile than the Chavies soil. Included areas make up less than 10 percent of this map unit. They are less than 2 acres in size.

Most areas of the Chavies soil support grasses. A few areas are used for row crops.

This soil is suited to all of the row crops commonly grown in the area. The hazard of erosion is very severe if conventional tillage methods are used. Contour farming, stripcropping, and conservation tillage help to control erosion and runoff. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence.

This soil is well suited to most of the pasture and hay plants commonly grown in the area. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and weed control help to maintain the desired species.

This soil is well suited to woodland. Species preferred for planting include yellow poplar, eastern white pine, black walnut, northern red oak, white oak, shortleaf pine, and loblolly pine. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is poorly suited to most urban uses. The slope is a limitation affecting building site development and sanitary facilities. Seepage also is a limitation on sites for sanitary facilities.

This soil is in capability subclass IIIe.

Du—Dunning silty clay, frequently flooded. This very deep, very poorly drained or poorly drained, nearly level soil is in depressions on flood plains. Individual areas range from about 3 to 91 acres in size. Sloughs, ditches, and small streams dissect most areas. Slopes are smooth and range from 0 to 2 percent.

Typically, the surface layer is very dark gray silty clay about 7 inches thick. The subsurface layer is very dark gray clay about 14 inches thick. The subsoil extends to a depth of about 46 inches. It is mottled clay. The upper part is dark gray, and the lower part is gray. The substratum to a depth of about 62 inches is dark gray, mottled clay.

This soil is medium in natural fertility and high in organic matter content. Permeability is slow, and the available water capacity is high. In winter and spring, the water table is within a depth of about 0.5 foot. Tilth is poor because of the high content of clay in the surface layer. The soil is plastic and sticky when wet. It is frequently flooded for brief periods. The root zone is very deep. The shrink-swell potential is moderate.

Included with this soil in mapping are small areas of Lindside, Melvin, and Newark soils. These soils are in landscape positions similar to those of the Dunning soil. Also included are small areas of soils that are similar to the Dunning soil but have a brown surface layer. Included areas make up 5 to 10 percent of this map unit. They are less than 2 acres in size.

Most areas of the Dunning soil have been cleared and are used for pasture and hay. A few areas are used for row crops or are wooded.

This soil is poorly suited to row crops. It is limited by the wetness, the flooding, and the clayey surface layer.

This soil is suited to pasture and hay. Grasses and legumes that can tolerate the wetness and the flooding are best suited. Restricted grazing during wet periods to prevent soil compaction and excessive damage to the plants. Applications of fertilizer, adequate drainage, proper stocking rates, rotation grazing, and weed control are suitable management practices.

This soil is well suited to woodland. Species preferred for planting include pin oak, American sycamore, baldcypress, swamp white oak, and sweetgum. Management concerns include the equipment limitation, seedling mortality, and plant competition. The seasonal high water table and the wetness restrict the use of equipment. Competition from undesirable plants can hinder natural or artificial reforestation. Intensive site preparation and maintenance may be needed. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for wetland wildlife.

This soil is poorly suited to urban uses. The flooding and the wetness are the main limitations. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IIIw.

EkA—Elk silt loam, 0 to 2 percent slopes. This very deep, well drained, nearly level soil is on stream terraces throughout the county. Individual areas range from about 4 to 61 acres in size.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of about 76 inches. It is strong brown silt loam in the upper part, strong brown silty clay loam in the next part, and strong brown silt loam in the lower part. The substratum to a depth of about 96 inches is brown and strong brown, mottled, stratified silt loam and loam.

This soil is high in natural fertility and moderate in organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is good. The soil can be cultivated throughout a wide range in moisture content. The root zone is very deep and can be easily penetrated by plant roots.

Included with this soil in mapping are small areas of Ashton, Chavies, Otwell, and Wheeling soils. These soils are in landscape positions similar to those of the Elk soil. Also included are a few low areas that are subject to flooding in winter and early spring. Included areas make up less than 10 percent of this map unit. They are less than 2 acres in size.

Most areas of the Elk soil are used extensively for row crops. A few areas are used for hay and pasture.

This soil is well suited to all of the row crops commonly grown in the area. Applying a system of conservation tillage, implementing crop residue management techniques, and growing cover crops can maintain desirable soil structure, fertility, tilth, and organic matter content.

This soil is suited to all of the pasture and hay plants commonly grown in the area. Maintaining the desired species, controlling weeds, maintaining proper stocking rates, rotation grazing, and applying lime and fertilizer are suitable management practices.

This soil is well suited to woodland. Species preferred for planting include eastern white pine, yellow poplar, black walnut, loblolly pine, white oak, northern red oak, cherrybark oak, white ash, and shortleaf pine. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is well suited to most urban uses. The restricted permeability is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability class I.

EkB—Elk silt loam, 2 to 6 percent slopes. This very deep, well drained, gently sloping soil is on stream terraces throughout the county. Individual areas range from about 3 to 83 acres in size.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of about 76 inches. It is strong brown silt loam in the upper part, strong brown silty clay loam in the next part, and strong brown silt loam in the lower part. The substratum to a depth of about 96 inches is brown and strong brown, mottled, stratified silt loam and loam.

This soil is high in natural fertility and moderate in organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is good. The soil can be cultivated throughout a wide range in moisture content. The root zone is very deep and can be easily penetrated by plant roots.

Included with this soil in mapping are small areas of Ashton, Chavies, Otwell, and Wheeling soils. These soils are in landscape positions similar to those of the Elk soil. Also included are a few low areas that are subject to flooding for brief periods. Included areas make up less than 10 percent of this map unit. They are less than 2 acres in size.

Most areas of the Elk soil are used for corn, small grain, or soybeans. A few areas are used for hay and pasture.

This soil is well suited to all of the row crops commonly grown in the area. The hazard of erosion is moderate if conventional tillage methods are used. Applying a system of conservation tillage, stripcropping, implementing crop residue management techniques, growing cover crops, and including grasses and legumes in the cropping sequence help to control erosion and runoff.

This soil is well suited to the pasture and hay plants commonly grown in the area. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and control of undesirable vegetation are suitable management practices.

This soil is well suited to woodland. Species preferred for planting include eastern white pine, yellow poplar, black walnut, loblolly pine, white oak, northern red oak, cherrybark oak, white ash, and shortleaf pine. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is well suited to most urban uses. The restricted permeability is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IIe.

EkC—Elk silt loam, 6 to 12 percent slopes. This very deep, well drained, sloping soil is on stream terraces throughout the county. Individual areas range from about 3 to 37 acres in size.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of about 76 inches. It is strong brown silt loam in the upper part, strong brown silty clay loam in the next part, and strong brown silt loam in the lower part. The substratum to a depth of about 96 inches is brown and strong brown, mottled, stratified silt loam and loam.

This soil is high in natural fertility and moderate in organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is good. The soil can be worked throughout a wide range in moisture content. The root zone is very deep and can be easily penetrated by plant roots.

Included with this soil in mapping are small areas of Ashton, Chavies, Otwell, and Wheeling soils. These soils are in landscape positions similar to those of the Elk soil. Also included are a few areas that are subject to flooding from backwater. Included areas make up less than 10 percent of this map unit. They are less than 2 acres in size.

Most areas of the Elk soil are used for corn, small grain, or soybeans. A few areas are used for hay and pasture.

This soil is suited to all of the row crops commonly grown in the area. The hazard of erosion is severe if conventional tillage methods are used. Conservation tillage, contour farming, stripcropping, water disposal systems, crop residue management, and a cropping sequence that includes cover crops and grasses and legumes help to control erosion and runoff and maintain tilth and organic matter content.

This soil is well suited to the pasture and hay plants commonly grown in the area. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and control of undesirable vegetation are suitable management practices.

This soil is well suited to woodland. Species preferred for planting include eastern white pine, yellow poplar, black walnut, loblolly pine, white oak, northern red oak, cherrybark oak, white ash, and shortleaf pine. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is suited to most urban uses. The slope is a limitation affecting most kinds of building site development and sanitary facilities. The restricted permeability also is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IIIe.

FrD—Frondorf silt loam, 12 to 20 percent slopes. This moderately deep, well drained, moderately steep soil is on upland side slopes, mainly north of the Cumberland River. Slopes are irregular and convex. Individual areas range from about 3 to 187 acres in size.

Typically, the surface layer is dark brown silt loam about 2 inches thick. The subsurface layer is yellowish brown gravelly silt loam about 6 inches thick. The subsoil extends to a depth of about 37 inches. It is yellowish brown silt loam and silty clay loam in the upper part and strong brown gravelly silt loam and very channery silty clay loam in the lower part. Sandstone bedrock is at a depth of about 37 inches.

This soil is medium in natural fertility and low to moderate in organic matter content. Permeability and the available water capacity are moderate. Tilth is good. The root zone and the depth to bedrock range from 20 to 40 inches.

Included with this soil in mapping are small areas of Faywood, Lowell, Wellston, and Zanesville soils. These soils are in landscape positions similar to those of the Frondorf soil. Included areas make up less than 15 percent of this map unit. They are generally long and narrow and are less than 3 acres in size.

Most areas of the Frondorf soil are wooded. A few small areas are used for pasture and hay.

This soil is suited to limited production of row crops and small grain. The hazard of erosion is very severe if conventional tillage methods are used. The slope is the main limitation. Contour farming, stripcropping, and conservation tillage help to control runoff and erosion. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence.

This soil is suited to hay and pasture. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and weed control help to maintain the desired plants.

This soil is suited to woodland. Upland oaks and hickory are the dominant native trees. Species preferred for planting include shortleaf pine, white oak, and loblolly pine. Management concerns on both cool and warm aspects of this soil include the hazard of erosion, the equipment limitation, and plant competition. Seedling mortality is an additional management concern on warm aspects. Steep skid trails or roads are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. The slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and results in less disturbance of the surface layer. Competition from undesirable plants can hinder natural or artificial reforestation. Intensive site preparation and maintenance may be needed. See table 7 for specific information relating to potential productivity and appropriate trees to plant on warm and cool aspects of this soil.

This soil is well suited to woodland wildlife habitat.

This soil is poorly suited to urban uses. The slope and the depth to bedrock are the main limitations.

This soil is in capability subclass IVe.

FrD3—Frondorf silt loam, 12 to 20 percent slopes, severely eroded. This moderately deep, well drained, moderately steep soil is on upland side slopes dominantly north of the Cumberland River. Slopes are irregular and convex. Individual areas range from about 3 to 118 acres in size. Erosion has removed most of the original surface layer and in places has removed some of the subsoil. Some areas have rills and shallow gullies.

Typically, the surface layer is brown silt loam about 2 inches thick. The subsoil extends to a depth of about 27 inches. It is yellowish brown silt loam in the upper part, strong brown silt loam in the next part, and strong brown very channery silt loam in the lower part. Sandstone bedrock is at a depth of about 27 inches.

This soil is low in natural fertility and organic matter content. Permeability and the available water capacity are moderate. The root zone and the depth to bedrock range from 20 to 40 inches.

Included with this soil in mapping are small areas of Faywood, Lowell, Wellston, and Zanesville soils. These soils are in landscape positions similar to those of the Frondorf soil. Included areas make up less than 15 percent of this map unit. They are generally long and narrow and are less than 3 acres in size.

Most areas of the Frondorf soil are wooded. A few small areas are used for pasture and hay.

This soil is not suited to row crops and small grain because of the slope and because of damage from past erosion.

This soil is suited to pasture and hay. Applications of lime and fertilizer, weed and brush control, rotation grazing, and proper stocking rates help to maintain the desired plants.

This soil is suited to woodland. Upland oaks and hickory are the dominant native trees. Species preferred for planting include shortleaf pine and loblolly pine. Management concerns on both cool and warm aspects of this soil include the hazard of erosion, the equipment limitation, and plant competition. Seedling mortality is an additional management concern on warm aspects. Steep skid trails or roads are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. The slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and results in less disturbance of the surface layer. Competition from undesirable plants can hinder natural or artificial reforestation. Intensive site preparation and maintenance may be needed. See table 7 for specific information relating to potential productivity and appropriate trees to plant on warm and cool aspects of this soil.

This soil is well suited to habitat for woodland wildlife.

This soil is poorly suited to urban uses. The slope and the depth to bedrock are the main limitations.

This soil is in capability subclass VIe.

FrE—Frondorf silt loam, 20 to 30 percent slopes. This moderately deep, well drained, steep soil is on upland side slopes, mainly north of the Cumberland River. Individual areas range from about 3 to 337 acres in size. Most areas are dissected by intermittent drains. Slopes are irregular and convex.

Typically, the surface layer is dark brown silt loam about 2 inches thick. The subsurface layer is yellowish brown gravelly silt loam about 6 inches thick. The subsoil extends to a depth of about 37 inches. It is yellowish brown silt loam and silty clay loam in the upper part and strong brown gravelly silt loam and very channery silty clay loam in the lower part. Sandstone bedrock is at a depth of about 37 inches.

This soil is medium in natural fertility and low to moderate in organic matter content. Permeability and the available water capacity are moderate. The root zone and the depth to bedrock range from 20 to 40 inches.

Included with this soil in mapping are small areas of Faywood, Lowell, Wellston, and Zanesville soils. These soils are in landscape positions similar to those of the Frondorf soil. Also included are small areas of soils that are shallow over bedrock. Included areas make up less than 15 percent of this map unit. They are generally long and narrow and are less than 3 acres in size.

Most areas of the Frondorf soil are wooded. A few small areas are used for pasture or meadow.

This soil is not suited to row crops and small grain because of the slope and the very severe hazard of erosion.

This soil is suited to pasture. It is poorly suited to hay because of the slope. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Frequent pasture renovation helps to maintain the desired species. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and control of undesirable vegetation are suitable management practices.

This soil is suited to woodland. Upland oaks and hickory are the dominant native trees. Species preferred for planting include shortleaf pine, white oak, and loblolly pine. Management concerns on both cool and warm aspects of this soil include the hazard of erosion, the equipment limitation, and plant competition. Seedling mortality is an additional management concern on warm aspects. Steep skid trails or roads are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. The slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding generally is safer and results in less disturbance of the surface layer. Competition from undesirable plants can hinder natural or artificial reforestation. Intensive site preparation and maintenance may be needed. See table 7 for specific information relating to potential productivity and appropriate trees to plant on warm and cool aspects of this soil.

This soil is well suited to habitat for woodland wildlife.

This soil is poorly suited to urban uses. The slope and the depth to bedrock are the main limitations.

This soil is in capability subclass VIe.

HaC—Hammack silt loam, 6 to 12 percent slopes. This very deep, well drained, sloping soil is on upland ridgetops and side slopes, mainly in the central part of the county. Individual areas range from about 4 to 69 acres in size.

Typically, the surface layer is yellowish brown silt loam about 7 inches thick. The subsoil extends to a depth of about 76 inches. It is brown silty clay loam in the upper part, brown extremely gravelly silty clay loam in the next part, and yellowish red clay, reddish brown gravelly clay, and reddish brown very gravelly clay in the lower part.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is good. The soil can be worked throughout a wide range in moisture content. The root zone is very deep. The shrink-swell potential is moderate below a depth of about 40 inches.

Included with this soil in mapping are small areas of Baxter and Nicholson soils. These soils are in landscape positions similar to those of the Hammack soil. Included areas make up less than 10 percent of this map unit. They are less than 2 acres in size.

Most areas of the Hammack soil are used for row crops or pasture and hay. A few areas are wooded.

This soil is suited to row crops. The hazard of erosion is severe if conventional tillage methods are used. Practices that slow surface runoff and help to control erosion include conservation tillage, contour farming, stripcropping, water disposal systems, and cover crops. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence.

This soil is well suited to the pasture and hay plants commonly grown in the area. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Frequent pasture renovation helps to maintain the desired species. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and control of undesirable vegetation are suitable management practices.

This soil is suited to woodland. Species preferred for planting include yellow poplar, northern red oak, shortleaf pine, loblolly pine, and eastern white pine. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is suited to most urban uses. The slope and the high content of clay in the subsoil are the main limitations. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IIIe.

HaC3—Hammack silt loam, 6 to 12 percent slopes, severely eroded. This very deep, well drained, sloping soil is on upland side slopes, mainly in the central part of the county. Individual areas range from about 3 to 60 acres in size. Erosion has removed most of the original surface layer and in places has removed some of the subsoil. Some areas have rills and shallow gullies.

Typically, the surface layer is yellowish brown silt loam about 6 inches thick. The subsoil extends to a depth of about 60 inches. It is strong brown silt loam in the upper part, strong brown very gravelly silt loam in the next part, and red gravelly silty clay in the lower part.

This soil is low in natural fertility and organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is fair. The root zone is very deep. The shrink-swell potential is moderate below a depth of about 22 inches.

Included with this soil in mapping are small areas of Baxter and Nicholson soils. These soils are in landscape positions similar to those of the Hammack soil. Included areas make up less than 10 percent of this map unit. They are less than 2 acres in size.

Most areas of the Hammack soil are used for pasture and hay. Some areas are used for row crops, mostly corn and soybeans.

This soil is suited to limited production of row crops. The hazard of erosion is very severe if conventional tillage methods are used. Conservation tillage and contour farming help to control erosion and runoff. Tilth and the organic matter content can be improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence.

This soil is suited to pasture and hay. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Applications of lime and fertilizer, control of weeds and brush, rotation grazing, and proper stocking rates are suitable management practices.

This soil is suited to woodland. Species preferred for planting include eastern white pine, loblolly pine, white oak, and shortleaf pine. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is suited to most urban uses. The slope and the high content of clay in the subsoil are the main limitations. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IVe.

HaD—Hammack silt loam, 12 to 20 percent slopes. This very deep, well drained, moderately steep soil is on upland side slopes, mainly in the central part of the county. Individual areas range from about 3 to 156 acres in size.

Typically, the surface layer is yellowish brown silt loam about 7 inches thick. The subsoil extends to a depth of about 76 inches. It is brown silty clay loam in the upper part, brown extremely gravelly silty clay loam in the next part, and yellowish red clay, reddish brown gravelly clay, and reddish brown very gravelly clay in the lower part.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is good. The soil can be worked throughout a wide range in moisture content. The root zone is very deep. The shrink-swell potential is moderate below a depth of about 40 inches.

Included with this soil in mapping are small areas of Baxter and Nicholson soils. These soils are in landscape positions similar to those of the Hammack soil. Included areas make up less than 10 percent of this map unit. They are less than 2 acres in size.

Most areas of the Hammack soil are wooded or are used for pasture and hay. A few small areas are used for row crops.

This soil is suited to limited production of crops. The hazard of erosion is very severe if conventional tillage methods are used. Contour farming, stripcropping, and conservation tillage help to control runoff and erosion. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence.

This soil is suited to pasture and hay. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Frequent pasture renovation helps to maintain the desired species. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and control of undesirable vegetation are suitable management practices.

This soil is suited to woodland. Upland oaks, hickory, and maple are the dominant native trees. Species preferred for planting include yellow poplar, northern red oak, shortleaf pine, loblolly pine, and eastern white pine. Management concerns include the hazard of erosion, the equipment limitation, and plant competition. The slope restricts the use of wheeled equipment on skid trails. Cable yarding is generally safer and results in less disturbance of the surface layer. Competition from undesirable plants can hinder natural or artificial reforestation. Intensive site preparation and maintenance may be needed. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for woodland wildlife.

This soil is poorly suited to most urban uses. The slope is the main limitation. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IVe.

HaD3—Hammack silt loam, 12 to 20 percent slopes, severely eroded. This very deep, well drained, moderately steep soil is on upland side slopes, mainly in the central part of the county. Individual areas range from about 3 to 201 acres in size. Erosion has removed most of the original surface layer and in places has removed some of the subsoil. Some areas have rills and shallow gullies.

Typically, the surface layer is yellowish brown silt loam about 6 inches thick. The subsoil extends to a depth of about 60 inches. It is strong brown silt loam in the upper part, strong brown very gravelly silt loam in the next part, and red gravelly silty clay in the lower part.

This soil is low in natural fertility and organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is fair. The root zone is very deep. The shrink-swell potential is moderate below a depth of about 22 inches.

Included with this soil in mapping are small areas of Baxter and Nicholson soils. These soils are in landscape positions similar to those of the Hammack soil. Included areas make up less than 10 percent of this map unit. They are less than 2 acres in size.

Most areas of the Hammack soil are wooded or are used for pasture and hay. A few small areas are used for row crops.

This soil is poorly suited to row crops.

This soil is suited to pasture and hay. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Applications of fertilizer and lime, control of weeds and brush, rotation grazing, and proper stocking rates are suitable management practices.

This soil is suited to woodland. Upland oaks, hickory, and maple are native trees. Species preferred for planting include eastern white pine, shortleaf pine, loblolly pine, and white oak. Management concerns include the hazard of erosion, the equipment limitation, and plant competition. The slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding is generally safer and results in less disturbance of the surface layer. Competition from undesirable plants can hinder natural or artificial reforestation. Intensive site preparation and maintenance may be needed. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for woodland wildlife.

This soil is poorly suited to most urban uses. The slope is the main limitation. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass VIe.

Hn—Henshaw silt loam, rarely flooded. This very deep, somewhat poorly drained, nearly level soil is on stream terraces along the larger streams throughout the county. Individual areas range from about 3 to 346 acres in size. Some areas are dissected by drainage ditches. Slopes range from 0 to 2 percent.

Typically, the surface layer is brown silt loam about 6 inches thick. The subsoil extends to a depth of about 63 inches. It is light olive brown, mottled silt loam in the upper part; light yellowish brown, mottled silty clay loam in the next part; and light brownish gray, mottled silty clay loam in the lower part.

This soil is medium in natural fertility and low in organic matter content. Permeability is moderately slow, and the available water capacity is high. The root zone is very deep. Tilth is good. The soil can be worked throughout a wide range in moisture content. A seasonal high water table is at a depth of 1 to 2 feet during winter and early spring. This soil is subject to rare flooding.

Included with this soil in mapping are small areas of McGary, Otwell, and Peoga soils. These soils are in landscape positions similar to those of the Henshaw soil. Also included are small areas of soils that are similar to the Henshaw soil but have a weak fragipan. Included areas make up less than 10 percent of this map unit. They are less than 2 acres in size.

Most areas of the Henshaw soil are used for row crops. A few areas are used for pasture or woodland.

This soil is well suited to row crops. Tilling only during periods of favorable moisture conditions helps to prevent clodding and crusting. Cultivation and harvesting may be delayed in some years because of the wetness. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence.

This soil is suited to pasture and hay. Grasses and legumes that can tolerate the wetness and the flooding are best suited. Restricted grazing during wet periods helps to prevent soil compaction and excessive damage to the plants. Applications of fertilizer and lime, proper stocking rates, rotation grazing, and weed control are suitable management practices.

This soil is well suited to woodland. Species preferred for planting include green ash, sweetgum, eastern cottonwood, eastern white pine, and loblolly pine. The main management concerns are the equipment limitation and plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is poorly suited to most urban uses. The flooding and the wetness are the main limitations. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill.

This soil is in capability subclass IIw.

Hu—Huntington silt loam, frequently flooded. This very deep, well drained, nearly level soil is on flood plains along the Ohio, Cumberland, and Tennessee Rivers. Individual areas range from about 4 to 1,725 acres in size. Some areas are dissected by ditches and small streams. Slopes range from 0 to 2 percent.

Typically, the surface layer is dark brown silt loam about 13 inches thick. The subsoil extends to a depth of about 70 inches. It is silt loam. The upper part is dark grayish brown, and the lower part is brown. The substratum to a depth of about 84 inches is brown, stratified silt loam, loam, and fine sand.

This soil is high in natural fertility and organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is good. The soil can be cultivated throughout a wide range in moisture content. It is frequently flooded for brief periods. The root zone is very deep.

Included with this soil in mapping are small areas of Ashton, Nelse, and Nolin soils. These soils are in landscape positions similar to those of the Huntington soil. Also included are small areas of soils that have a surface layer of loamy overwash. Included areas make up less than 15 percent of this map unit. They are generally less than 2 acres in size.

Most areas of the Huntington soil are used for row crops.

This soil is well suited to row crops. Good tilth and organic matter content can be maintained by implementing crop residue management techniques. Small grain is sometimes damaged by winter flooding.

This soil is suited to hay and pasture. Applications of fertilizer, control of weeds and brush, rotation grazing, and proper stocking rates are suitable management practices. Hay crops can be damaged in some years by the flooding.

This soil is well suited to woodland. Species preferred for planting include yellow poplar, black walnut, white ash, northern red oak, loblolly pine, and eastern white pine. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is poorly suited to most urban uses. The flooding is the main limitation.

This soil is in capability subclass IIw.

Ka—Karnak silty clay, frequently flooded. This very deep, poorly drained and very poorly drained, nearly level soil is on flood plains along the Tennessee and Cumberland Rivers and near their confluence along the Ohio River. Individual areas range from about 6 to 206 acres in size. Some areas are dissected by ditches or small streams. Slopes range from 0 to 2 percent.

Typically, the surface layer is brown silty clay about 4 inches thick. The subsoil extends to a depth of about 44 inches. It is mottled clay. The upper part is dark grayish brown, the next part is gray, and the lower part is grayish brown. The substratum to a depth of about 62 inches also is mottled clay. The upper part is grayish brown, and the lower part is gray.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is very slow or slow, and the available water capacity is high. Tilth is poor. The soil is plastic and sticky when wet. It crusts and becomes cloddy if cultivated when too wet. The root zone is very deep. A seasonal high water table is within a depth of 3 feet. The soil is frequently flooded for brief periods. The shrink-swell potential is high.

Included with this soil in mapping are small areas of Dunning, Lindside, Melvin, and Newark soils. These soils are in landscape positions similar to those of the Karnak soil. Also included are small areas of Henshaw, Licking, and McGary soils on low stream terraces. Included areas make up less than 5 percent of this map unit. They are generally less than 2 acres in size.

Most areas of the Karnak soil are used for row crops.

This soil is suited to row crops. The wetness, the flooding, and the clayey surface texture are management concerns. Planting and harvesting may be delayed in some years because of the wetness and the flooding. The flooding is a concern if small grain is grown.

This soil is suited to hay and pasture. The flooding, the wetness, and the risk of soil compaction are limitations. Pasture and hay plants that can tolerate the seasonal wetness and the flooding should be selected for planting. A drainage system, rotation grazing, weed control, and applications of fertilizer and lime are suitable management practices. Hay crops can be damaged in some years by the flooding.

This soil is well suited to woodland. Species preferred for planting include pin oak, swamp white oak, green ash, sweetgum, and baldcypress. Management concerns include the equipment limitation, seedling mortality, and plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for wetland wildlife.

This soil is poorly suited to urban uses. The flooding and the wetness are the main limitations affecting most kinds of building site development and sanitary facilities. The slow permeability also is a limitation on sites for most kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill.

This soil is in capability subclass IIIw.

LcB—Licking silt loam, 2 to 6 percent slopes. This very deep, moderately well drained, gently sloping soil is on stream terraces along the major streams throughout the county. Individual areas range from about 3 to 173 acres in size.

Typically, the surface layer is brown silt loam about 6 inches thick. The subsoil extends to a depth of about 60 inches. It is strong brown silty clay loam in the upper part; strong brown, mottled silty clay in the next part; and yellowish brown, mottled silty clay in the lower part. The substratum to a depth of about 75 inches is yellowish brown, mottled silt loam.

This soil is medium in natural fertility and moderate in content of organic matter. Permeability is moderately slow in the upper part of the subsoil and slow in the lower part. The available water capacity is high. Tilth is good. The soil can be cultivated throughout a wide range in moisture content. The root zone is very deep and can be easily penetrated by plant roots. A seasonal high water table is at a depth of 2.0 to 3.5 feet. The shrink-swell potential is moderate in the upper part of the subsoil and high in the lower part.

Included with this soil in mapping are small areas of Henshaw, McGary, Otwell, and Peoga soils. These soils are in landscape positions similar to those of the Licking soil. Included areas make up less than 10 percent of this map unit. They are less than 3 acres in size.

Most areas of the Licking soil are used for row crops. A few areas are used for pasture and hay.

This soil is well suited to row crops and small grain. The hazard of erosion is moderate if conventional tillage methods are used. Conservation tillage, no-till farming, and a cropping system that includes grasses and legumes help to control runoff and erosion. Good tilth can be easily maintained by implementing crop residue management techniques.

This soil is well suited to hay and pasture. Applications of fertilizer and lime, control of weeds and brush, rotation grazing, and proper stocking rates are suitable management practices.

This soil is well suited to woodland. Species preferred for planting include white oak, yellow poplar, white ash, northern red oak, and eastern white pine. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is poorly suited to most urban uses. The shrink-swell potential and the wetness are limitations affecting most kinds of building site development. The wetness and the slow permeability are limitations on sites for sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IIe.

LkC3—Licking silty clay loam, 6 to 12 percent slopes, severely eroded. This very deep, moderately well drained, sloping soil is on stream terraces along the major streams throughout the county. Individual areas range from about 3 to 54 acres in size. Erosion has removed most of the original surface layer and in places has removed some of the subsoil. Some areas have rills and shallow gullies.

Typically, the surface layer is yellowish brown silty clay loam about 3 inches thick. The subsoil extends to a depth of about 36 inches. The upper part is yellowish brown, mottled silty clay. The lower part is yellowish brown, mottled silty clay loam. The substratum to a depth of about 63 inches is yellowish brown, mottled silt loam.

This soil is low in natural fertility and organic matter content. Permeability is moderately slow in the upper part of the subsoil and slow in the lower part. The available water capacity is high. The root zone is very deep. Tilth is fair. A seasonal high water table is at a depth of 2.0 to 3.5 feet. The shrink-swell potential is moderate in the upper part of the subsoil and high in the lower part.

Included with this soil in mapping are small areas of Elk, McGary, and Otwell soils. These soils are in landscape positions similar to those of the Licking soil. Also included are small areas that have slopes of more than 12 percent. Included areas make up less than 10 percent of this map unit. They are less than 3 acres in size.

Most areas of the Licking soil are used for pasture. A few areas are used for row crops.

This soil is suited to limited production of row crops. The hazard of erosion is very severe if conventional tillage methods are used. Contour farming, stripcropping, and conservation tillage help to control runoff and erosion. Tilth and the organic matter content can be improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence.

This soil is suited to hay and pasture. Establishing vegetation is somewhat difficult because erosion has removed most of the original surface layer. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Frequent pasture renovation helps to maintain the desired species. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and control of undesirable vegetation are suitable management practices.

This soil is well suited to woodland. Species preferred for planting include white oak, yellow poplar, white ash, northern red oak, and eastern white pine. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is poorly suited to most urban uses. The wetness and the shrink-swell potential are limitations affecting most kinds of building site development. The wetness, the slope, and the slow permeability are limitations affecting most kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IVe.

Ln—Lindside silt loam, frequently flooded. This very deep, moderately well drained, nearly level soil is on flood plains throughout the county. Individual areas range from about 3 to 337 acres in size. Some areas are dissected by ditches and small streams. Slopes range from 0 to 2 percent.

Typically, the surface layer is brown silt loam about 5 inches thick. The subsoil extends to a depth of about 34 inches. It is dark yellowish brown silt loam in the upper part and brown, mottled silt loam in the lower part. The upper part of the substratum is grayish brown, mottled silty clay loam. The lower part to a depth of about 85 inches is gray, mottled, stratified silty clay loam, loam, and silt loam.

This soil is high in natural fertility and moderate in organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is good. The soil can be worked throughout a wide range in moisture content. Depth to the seasonal high water table ranges from 1.5 to 3.0 feet. The root zone is very deep and can be easily penetrated by plant roots. The soil is frequently flooded for very brief or brief periods.

Included with this soil in mapping are small areas of Huntington, Newark, and Nolin soils. These soils are in landscape positions similar to those of the Lindside soil. Included areas make up less than 10 percent of this map unit. They are less than 1 acre in size.

Most areas of the Lindside soil are used for row crops. Some areas are used for pasture or woodland.

This soil is well suited to row crops. Small grain can be damaged in many years by winter flooding. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence.

This soil is suited to hay and pasture. Applications of fertilizer, control of weeds and brush, rotation grazing, and proper stocking rates are suitable management practices. Hay crops can be damaged in some years by the flooding.

This soil is suited to woodland. Species preferred for planting include yellow poplar, eastern white pine, white oak, northern red oak, loblolly pine, and black walnut. The main management concerns are seedling mortality and plant competition. See table 7 for specific information relating to potential productivity.

This soil is suited to habitat for openland wildlife.

This soil is poorly suited to most urban uses. The flooding and the wetness are the main limitations.

This soil is in capability subclass IIw.

LoB—Loring silt loam, 2 to 6 percent slopes. This very deep, moderately well drained, gently sloping soil is on upland ridgetops throughout the county. It has a fragipan. Slopes are smooth and convex. Individual areas range from about 3 to 661 acres in size.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of about 55 inches. The upper part is strong brown silt loam. The lower part is a firm, brittle, compact fragipan of strong brown and brown, mottled silt loam. The substratum to a depth of about 65 inches is strong brown silt loam.

This soil is medium in natural fertility and low in organic matter content. Permeability is moderate above the fragipan and moderately slow in the fragipan. The available water capacity is moderate. Tilth is good. The soil can be cultivated throughout a wide range in moisture content. The root zone is moderately deep. Roots and water can readily penetrate the soil above the fragipan but are restricted in the fragipan. A perched high water table is at a depth of 2 to 3 feet.

Included with this soil in mapping are small areas of Memphis, Nicholson, and Zanesville soils. These soils are in landscape positions similar to those of the Loring soil. Included areas make up less than 10 percent of this map unit. They are generally less than 3 acres in size.

Most areas of the Loring soil are used mainly for row crops or for hay and pasture. A few areas are wooded.

This soil is well suited to most of the row crops and small grain commonly grown in the area. It is best suited to row crops that have shallow to moderately deep roots and that can tolerate slight wetness. The root zone is restricted by the fragipan, and during dry seasons plant production is limited. The hazard of erosion is moderate if conventional tillage methods are used. Practices that reduce surface runoff and help to control erosion include conservation tillage, contour farming, stripcropping, crop residue management, cover crops, and a cropping sequence that includes grasses and legumes.

This soil is well suited to most pasture and hay plants. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Frequent pasture renovation helps to maintain the desired species. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and control of undesirable vegetation are suitable management practices.

This soil is suited to woodland. Species preferred for planting include yellow poplar, white oak, northern red oak, loblolly pine, sweetgum, and eastern white pine. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is suited to most urban uses. The wetness is the main limitation affecting most kinds of building site development and sanitary facilities. The slow permeability also is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IIe.

LoC—Loring silt loam, 6 to 12 percent slopes. This very deep, moderately well drained, sloping soil is on upland ridgetops and side slopes throughout the county.

It has a fragipan. Individual areas range from about 3 to 295 acres in size.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of about 55 inches. The upper part is strong brown silt loam. The lower part is a firm, brittle, compact fragipan of strong brown and brown, mottled silt loam. The substratum to a depth of about 65 inches is strong brown silt loam.

This soil is medium in natural fertility and low in organic matter content. Permeability is moderate above the fragipan and moderately slow in the fragipan. The available water capacity is moderate. Tilth is good. The soil can be worked throughout a wide range in moisture content. The root zone is moderately deep. Roots and water can readily penetrate the soil above the fragipan but are restricted in the fragipan. A perched high water table is at a depth of 2 to 3 feet.

Included with this soil in mapping are small areas of Memphis, Nicholson, and Zanesville soils. These soils are in landscape positions similar to those of the Loring soil. Included areas make up less than 10 percent of this map unit. They are generally less than 3 acres in size.

Most areas of the Loring soil are used for corn, small grain, soybeans, or hay and pasture. A few areas are idle land or are wooded.

This soil is suited to all of the row crops commonly grown in the area. The hazard of erosion is severe if conventional tillage methods are used. Practices that slow surface runoff and help to control erosion include applying a system of conservation tillage and growing cover crops. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence.

This soil is well suited to most of the pasture and hay plants commonly grown in the area (fig. 8). Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Frequent pasture renovation helps to maintain the desired species. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and control of undesirable vegetation are suitable management practices.

This soil is suited to woodland. Species preferred for planting include loblolly pine and shortleaf pine. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is poorly suited to most urban uses. The wetness and the slope are the main limitations affecting most kinds of building site development and sanitary facilities. The slow permeability also is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IIIe.

LoC3—Loring silt loam, 6 to 12 percent slopes, severely eroded. This very deep, moderately well drained, sloping soil is on upland side slopes throughout the county. It has a fragipan. Individual areas range from about 3 to 385 acres in size. Erosion has removed most of the original surface layer and in places has removed some of the subsoil. Some areas have rills and shallow gullies.

Typically, the surface layer is dark yellowish brown silt loam about 6 inches thick. The subsoil extends to a depth of about 70 inches. The upper part is yellowish brown and brown silt loam. The lower part is a firm, compact, brittle fragipan of brown, mottled silt loam.

This soil is low in natural fertility and organic matter content. Permeability is moderate above the fragipan and moderately slow in the fragipan. The available water capacity is moderate. Tilth is fair. The soil becomes cloddy and crusts unless cultivated within a suitable range in moisture content. The root zone is shallow to moderately deep. The fragipan restricts the penetration of roots and the downward movement of water. A perched high water table is at a depth of 2 to 3 feet.

Included with this soil in mapping are small areas of Brandon, Memphis, Nicholson, and Zanesville soils. These soils are in landscape positions similar to those of the Loring soil. Included areas make up less than 15 percent of this map unit. They are generally less than 3 acres in size.

Most areas of the Loring soil are used for corn, soybeans, or hay and pasture. A few areas are wooded.

This soil is suited to row crops and small grain. The hazard of erosion is very severe if conventional tillage methods are used. Practices that slow surface runoff and help to control erosion include conservation tillage, contour farming, stripcropping, water disposal systems, and cover crops. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence.

This soil is suited to hay and pasture. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Applications of fertilizer and lime, control of weeds and brush, rotation grazing, and proper stocking rates are suitable management practices.

Figure 8.—Bales of hay in an area of Loring silt loam, 6 to 12 percent slopes. The woodland in the background is in an area of Wellston-Frondorf silt loams, very rocky, 20 to 50 percent slopes.

This soil is suited to woodland. Species preferred for planting include loblolly pine and shortleaf pine. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is poorly suited to most urban uses. The slope and the wetness are the main limitations affecting most kinds of building site development and sanitary facilities. The slow permeability also is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IVe.

LoD—Loring silt loam, 12 to 20 percent slopes. This very deep, moderately well drained, moderately steep soil is on upland side slopes throughout the county. It has a fragipan. Individual areas range from about 3 to 151 acres in size.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of about 55 inches. The upper part is strong brown silt loam. The lower part is a firm, brittle, compact fragipan of strong brown and brown, mottled silt loam. The substratum to a depth of about 65 inches is strong brown silt loam.

This soil is medium in natural fertility and low in organic matter content. Permeability is moderate above the fragipan and moderately slow in the fragipan. The available water capacity is moderate. Tilth is good. The soil can be tilled throughout a wide range in moisture content. The root zone is moderately deep. Roots and water can readily penetrate the soil above the fragipan but are restricted in the fragipan. A perched high water table is at a depth of 2 to 3 feet.

Included with this soil in mapping are small areas of Brandon, Memphis, Nicholson, and Zanesville soils. These soils are in landscape positions similar to those of the Loring soil. Also included are small areas of severely eroded soils. Included areas make up less than 10 percent of this map unit. They are generally less than 3 acres in size.

Most areas of the Loring soil are used for corn, soybeans, or hay and pasture. A few areas are idle land or are wooded.

This soil is suited to limited production of row crops. The hazard of erosion is very severe if conventional tillage methods are used. Contour farming, stripcropping, and conservation tillage help to control runoff and erosion. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence.

This soil is suited to pasture and hay. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Frequent pasture renovation helps to maintain the desired species. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and control of undesirable vegetation are suitable management practices.

This soil is suited to woodland. Upland oaks and yellow poplar are the dominant native trees. Species preferred for planting include yellow poplar, white oak, northern red oak, loblolly pine, sweetgum, shortleaf pine, and eastern white pine. Management concerns include the hazard of erosion, the equipment limitation, and plant competition. See table 7 for specific information relating to potential productivity.

This soil is suited to habitat for openland wildlife and well suited to habitat for woodland wildlife.

This soil is poorly suited to most urban uses. The slope and the wetness are the main limitations affecting most kinds of building site development and sanitary facilities. The slow permeability also is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IVe.

LoD3—Loring silt loam, 12 to 20 percent slopes, severely eroded. This very deep, moderately well drained, moderately steep soil is on upland side slopes throughout the county. It has a fragipan. Individual areas range from about 3 to 200 acres in size. Erosion has removed most of the original surface layer and in places has removed some of the subsoil. Some areas have rills and shallow gullies.

Typically, the surface layer is dark yellowish brown silt loam about 6 inches thick. The subsoil extends to a depth of about 70 inches. The upper part is yellowish brown and brown silt loam. The lower part is a firm, compact, brittle fragipan of brown, mottled silt loam.

This soil is low in natural fertility and organic matter content. Permeability is moderate above the fragipan and moderately slow in the fragipan. The available water capacity is moderate. The root zone is shallow to moderately deep. The fragipan restricts the penetration of roots and the downward movement of water. A perched high water table is at a depth of 2 to 3 feet.

Included with this soil in mapping are small areas of Brandon, Memphis, Nicholson, and Zanesville soils. These soils are in landscape positions similar to those of the Loring soil. Included areas make up less than 15 percent of this map unit. They are generally less than 3 acres in size.

Most areas of the Loring soil are used for corn, soybeans, or hay and pasture. A few areas are idle land or are wooded.

This soil is not suited to row crops. The hazard of erosion is very severe if conventional tillage methods are used.

This soil is suited to pasture and hay (fig. 9). Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Frequent pasture renovation helps to maintain the desired species. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and control of

Figure 9.—An area of Loring silt loam, 12 to 20 percent slopes, severely eroded. This soil is best suited to permanent vegetative cover. The woodland in the background is in an area of Frondorf silt loam, 20 to 30 percent slopes.

undesirable vegetation are suitable management practices.

This soil is suited to woodland. Upland oaks and yellow poplar are the dominant native trees. Species preferred for planting include loblolly pine and shortleaf pine. Management concerns include the hazard of erosion, the equipment limitation, and plant competition. See table 7 for specific information relating to potential productivity.

This soil is suited to habitat for openland wildlife.

This soil is poorly suited to most urban uses. The slope and the wetness are the main limitations affecting most kinds of building site development and sanitary facilities. The slow permeability also is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass VIe.

LwD—Lowell-Faywood complex, 12 to 20 percent slopes, very stony. These very deep to moderately deep, well drained, moderately steep soils are on upland side slopes, mainly in the central and northern parts of the county. Individual areas range from about 5 to 55 acres in size. They are about 60 percent Lowell soil and 25 percent Faywood soil. Stones averaging 10 to 24 inches in diameter cover about 3 to 10 percent of the surface.

Typically, the surface layer of the Lowell soil is dark grayish brown silt loam about 4 inches thick. The subsoil extends to a depth of about 38 inches. It is yellowish brown silty clay loam in the upper part, strong brown silty clay and clay in the next part, and yellowish brown clay in the lower part. The substratum to a depth of about 44 inches is light brownish gray and weak red clay. Limestone bedrock is at a depth of about 44 inches.

The Lowell soil is low in natural fertility and moderate in organic matter content. The available water capacity is high, and permeability is moderately slow. The root zone is deep and very deep. The shrink-swell potential is moderate. The depth to bedrock ranges from 40 to more than 80 inches.

Typically, the surface layer of the Faywood soil is very dark grayish brown silty clay loam about 5 inches thick. The subsoil extends to a depth of about 36 inches. It is dark yellowish brown channery silty clay in the upper part, yellowish brown flaggy clay in the next part, and light olive brown, mottled very flaggy clay in the lower part. Limestone bedrock is at a depth of about 36 inches.

The Faywood soil is low in natural fertility and moderate in organic matter content. Permeability is moderately slow or slow, and the available water capacity is moderate. The root zone and the depth to bedrock range from 20 to 40 inches. The shrink-swell potential is moderate.

Included with these soils in mapping are small areas of Frondorf and Wellston soils near the upper part of the hillsides and small areas of Lindside and Nolin soils on the flood plains. Also included are small areas of rock outcrop and small areas of Lowell and Faywood soils that have boulders on the surface. Included areas make up about 15 percent of this map unit. They are generally less than 5 acres in size.

Most areas of the Lowell and Faywood soils are wooded. A few small areas are used for pasture.

These soils are poorly suited to row crops and small grain.

These soils are well suited to pasture and hay. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Frequent pasture renovation helps to maintain the desired species. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and control of undesirable vegetation are suitable management practices.

These soils are suited to woodland. Upland oaks, hickory, and maple are the dominant native trees. Species preferred for planting include white ash, white oak, eastern white pine, and northern red oak. Management concerns include the hazard of erosion, the equipment limitation, and plant competition. The slope restricts the use of wheeled equipment on skid trails. Cable yarding is generally safer and results in less disturbance of the surface layer. Competition from undesirable plants can hinder natural or artificial reforestation. Intensive site preparation and maintenance may be needed. See table 7 for specific information relating to potential productivity.

These soils are well suited to habitat for woodland wildlife.

These soils are poorly suited to urban uses. The slope and the depth to bedrock are the main limitations affecting most kinds of building site development and sanitary facilities. The slow permeability also is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill.

These soils are in capability subclass VIs.

LwE—Lowell-Faywood complex, 20 to 40 percent slopes, very stony. These very deep to moderately deep, well drained soils are on steep or very steep hillsides, mainly in the central and northern parts of the county. Individual areas range from about 3 to 474 acres in size. They are about 60 percent Lowell soil and 25 percent Faywood soil. Stones averaging 10 to 24 inches in diameter cover 3 to 10 percent of the surface.

Typically, the surface layer of the Lowell soil is dark grayish brown silt loam about 4 inches thick. The subsoil extends to a depth of about 38 inches. It is yellowish brown silty clay loam in the upper part, strong brown silty clay and clay in the next part, and yellowish brown clay in the lower part. The substratum to a depth of about 44 inches is light brownish gray and weak red clay. Limestone bedrock is at a depth of about 44 inches.

The Lowell soil is low in natural fertility and moderate in organic matter content. The available water capacity is high, and permeability is moderately slow. The root zone is deep and very deep. The shrink-swell potential is moderate. The depth to bedrock ranges from 40 to more than 80 inches.

Typically, the surface layer of the Faywood soil is very dark grayish brown silty clay loam about 5 inches thick. The subsoil extends to a depth of about 36 inches. It is dark yellowish brown channery silty clay in the upper part, yellowish brown flaggy clay in the next part, and light olive brown, mottled very flaggy clay in the lower part. Limestone bedrock is at a depth of about 36 inches.

The Faywood soil is low in natural fertility and moderate in organic matter content. Permeability is moderately slow or slow, and the available water capacity is moderate. The root zone and the depth to bedrock range from 20 to 40 inches. The shrink-swell potential is moderate.

Included with these soils in mapping are small areas of Frondorf and Wellston soils near the upper part of the hillsides and small areas of Lindside and Nolin soils on the flood plains. Also included are small areas of rock outcrop and small areas of Lowell and Faywood soils that have boulders on the surface. Included areas make up about 15 percent of this map unit. They are generally less than 5 acres in size.

Most areas of the Lowell and Faywood soils are wooded. A few areas that have slopes of less than 35 percent are used for pasture.

These soils are suited to pasture but are poorly suited to row crops. The slope and the very severe hazard of erosion are the main limitations. Maintaining good stands of grasses and legumes can help to control erosion in areas used for pasture.

These soils are suited to woodland. Upland oaks, hickory, and maple are the dominant native trees. Species preferred for planting include white ash, white oak, eastern white pine, and northern red oak. Management concerns include the hazard of erosion, the equipment limitation, and plant competition. The slope restricts the use of wheeled equipment on skid trails. Cable yarding is generally safer and results in less disturbance of the surface layer. Competition from undesirable plants can hinder natural or artificial reforestation. Intensive site preparation and maintenance may be needed. See table 7 for specific information relating to potential productivity.

These soils are well suited to habitat for woodland wildlife.

These soils are poorly suited to urban uses. The slope and the depth to bedrock are the main limitations affecting most kinds of building site development and sanitary facilities. The slow permeability also is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill.

These soils are in capability subclass VIe.

Mc—McGary silt loam, rarely flooded. This very deep, somewhat poorly drained, nearly level soil is on stream terraces throughout the county. Individual areas range from about 3 to 186 acres in size. The soil is dissected by sloughs and drainage ditches in some areas. Slopes are smooth and range from 0 to 2 percent.

Typically, the surface layer is brown silt loam about 7 inches thick. The subsoil to a depth of about 37 inches is yellowish brown, mottled silty clay. The substratum to a depth of about 72 inches is yellowish brown and brown, mottled silty clay.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is slow, and the available water capacity is high. Tilth is good. The root zone is very deep. Depth to the seasonal high water table ranges from 1 to 3 feet. The shrink-swell potential is high. The soil is subject to rare flooding.

Included with this soil in mapping are small areas of Henshaw, Licking, Otwell, and Peoga soils. These soils are in landscape positions similar to those of the McGary soil. Included areas make up less than 10 percent of this map unit. They are less than 3 acres in size.

Most areas of the McGary soil are used for row crops. A few areas are wooded or are used for pasture.

This soil is suited to row crops and small grain. The wetness is a limitation. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence. Planting or harvesting may be delayed in some years because of the wetness.

This soil is suited to pasture and hay, but species that can tolerate the wetness should be selected for planting. Applications of fertilizer, adequate drainage, proper stocking rates, rotation grazing, and weed control are suitable management practices. Hay crops can be damaged in some years by the flooding.

This soil is suited to woodland. Species preferred for planting include pin oak, baldcypress, American sycamore, green ash, loblolly pine, and eastern white pine. The main management concerns are the equipment limitation and plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is poorly suited to most urban uses. The flooding and the wetness are the main limitations. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IIIw.

Me—Melvin silt loam, frequently flooded. This very deep, poorly drained, nearly level soil is on flood plains along streams that drain into the Cumberland, Ohio, and Tennessee Rivers. Slopes range from 0 to 2 percent. Individual areas range from about 3 to 140 acres in size.

Typically, the surface layer is dark grayish brown, mottled silt loam about 9 inches thick. The subsoil to a depth of about 30 inches is light brownish gray, mottled silt loam. The substratum to a depth of about 62 inches also is light brownish gray, mottled silt loam.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is good. The root zone is very deep. A seasonal high water table is within a depth of 1 foot. The soil is frequently flooded for brief periods in winter and spring.

Included with this soil in mapping are small areas of Dunning, Lindside, Karnak, and Newark soils. These soils are in landscape positions similar to those of the Melvin soil. Included areas make up less than 10 percent of this map unit. They are less than 2 acres in size.

Most areas of the Melvin soil have been drained and are used for row crops. A few areas are wooded or are used for pasture.

Where this soil has been drained, it is suited to row crops. The hazard of flooding and the seasonal high water table are limitations in areas used for small grain. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence. Planting or harvesting may be delayed in some years because of the wetness and the flooding.

Where this soil has been drained, it is suited to pasture and hay. The flooding and the wetness are management concerns. Weed control, proper stocking rates, rotation grazing, and proper applications of fertilizer and lime can increase forage production. Pasture and hay species that can tolerate the seasonal wetness and the flooding should be selected for planting.

This soil is well suited to woodland. Species preferred for planting include baldcypress, American sycamore, sweetgum, pin oak, and loblolly pine. Management concerns include the equipment limitation, seedling mortality, and plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for wetland wildlife.

This soil is poorly suited to most urban uses. The flooding and the wetness are the main management concerns. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill.

This soil is in capability subclass IIIw.

MmB—Memphis silt loam, 2 to 6 percent slopes. This very deep, well drained, gently sloping soil is on upland ridgetops throughout the county. Individual areas range from about 3 to 632 acres in size.

Typically, the surface layer is dark yellowish brown silt loam about 7 inches thick. The subsoil extends to a depth of about 69 inches. It is silt loam. The upper part is strong brown, and the lower part is brown. The substratum to a depth of about 88 inches is brown silt loam.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is good. The soil can be worked throughout a wide range in moisture content. The root zone is very deep and can be easily penetrated by plant roots.

Included with this soil in mapping are small areas of Nicholson and Loring soils. These soils are in landscape positions similar to those of the Memphis soil. Included areas make up less than 10 percent of this map unit. They are less than 4 acres in size.

Most areas of the Memphis soil are used for row crops or pasture and hay. A few areas are wooded.

This soil is well suited to all of the row crops commonly grown in the area (fig. 10). The hazard of erosion is moderate if conventional tillage methods are used. Conservation tillage, cover crops, and contour farming help to control runoff and erosion. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence.

This soil is well suited to all of the pasture and hay plants commonly grown in the area. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Frequent pasture renovation helps to maintain the desired species. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and control of undesirable vegetation are suitable management practices.

This soil is well suited to woodland. Species preferred for planting include yellow poplar, sweetgum, black walnut, white ash, loblolly pine, and cherrybark oak. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is well suited to most urban uses. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill.

This soil is in capability subclass IIe.

MmC—Memphis silt loam, 6 to 12 percent slopes. This very deep, well drained, sloping soil is on upland ridgetops and side slopes throughout the county. Individual areas range from about 3 to 154 acres in size.

Typically, the surface layer is dark yellowish brown silt loam about 7 inches thick. The subsoil extends to a depth of about 69 inches. It is silt loam. The upper part is strong brown, and the lower part is brown. The substratum to a depth of about 88 inches is brown silt loam.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is good. The soil can be worked throughout a wide range in moisture content. The root zone is very deep and can be easily penetrated by plant roots.

Included with this soil in mapping are small areas of Nicholson and Loring soils. These soils are in landscape positions similar to those of the Memphis soil. Included areas make up less than 10 percent of this map unit. They are less than 4 acres in size.

Most areas of the Memphis soil are used for row crops or hay and pasture. A few areas are wooded.

Figure 10.—Corn silage in an area of Memphis silt loam, 2 to 6 percent slopes.

This soil is suited to all of the row crops commonly grown in the area. The hazard of erosion is severe if conventional tillage methods are used. Terraces, conservation tillage, contour farming, and cover crops help to control runoff and erosion. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence.

This soil is well suited to pasture and hay. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Frequent pasture renovation helps to maintain the desired species. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and control of undesirable vegetation are suitable management practices.

This soil is well suited to woodland. Species preferred for planting include yellow poplar, sweetgum, black walnut, white ash, loblolly pine, and cherrybark oak. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is suited to most urban uses. The slope is the main limitation. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill.

This soil is in capability subclass IIIe.

MmC3—Memphis silt loam, 6 to 12 percent slopes, severely eroded. This very deep, well drained, sloping soil is on upland side slopes throughout the county. Individual areas range from about 4 to 287 acres in size. Erosion has removed most of the original surface layer and in places has removed some of the subsoil. Some areas have rills and shallow gullies.

Typically, the surface layer is dark yellowish brown silt loam about 2 inches thick. The subsoil extends to a depth of about 63 inches. It is silt loam. The upper part is strong brown, and the lower part is brown. The substratum to a depth of about 84 inches is yellowish red silt loam.

This soil is low in natural fertility and organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is fair. The soil crusts and becomes cloddy if worked when the moisture content is too high. The root zone is very deep and can be easily penetrated by plant roots.

Included with this soil in mapping are small areas of Nicholson, Loring, and Zanesville soils. These soils are in landscape positions similar to those of the Memphis soil. Included areas make up less than 15 percent of this map unit. They are generally less than 4 acres in size.

Most areas of the Memphis soil are used for pasture and hay. Some areas are used for row crops.

This soil is suited to row crops and small grain. The hazard of erosion is very severe if conventional tillage methods are used. Contour farming, stripcropping, and conservation tillage help to control runoff and erosion. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence.

This soil is suited to pasture and hay. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Applications of fertilizer and lime, control of weeds and brush, rotation grazing, and proper stocking rates are suitable management practices.

This soil is well suited to woodland. Species preferred for planting include yellow poplar, sweetgum, black walnut, white ash, loblolly pine, and cherrybark oak. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is suited to most urban uses. The slope is the main limitation. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill.

This soil is in capability subclass IVe.

MmD—Memphis silt loam, 12 to 30 percent slopes. This very deep, well drained, moderately steep or steep soil is on upland side slopes throughout the county. Individual areas range from about 3 to 60 acres in size.

Typically, the surface layer is dark yellowish brown silt loam about 7 inches thick. The subsoil extends to a depth of about 69 inches. It is silt loam. The upper part is strong brown, and the lower part is brown. The substratum to a depth of about 88 inches is brown silt loam.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is good. The soil can be worked throughout a wide range in moisture content. The root zone is very deep and can be easily penetrated by plant roots.

Included with this soil in mapping are small areas of Loring, Nicholson, and Zanesville soils. These soils are in landscape positions similar to those of the Memphis soil. Included areas make up less than 10 percent of this map unit. They are less than 4 acres in size.

Most areas of the Memphis soil are used for pasture and hay. A few areas are used for crops or woodland.

This soil is suited to limited production of row crops. The hazard of erosion is very severe if conventional tillage methods are used. Contour farming, stripcropping, and conservation tillage help to control runoff and erosion. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence.

This soil is suited to hay and pasture. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Frequent pasture renovation helps to maintain the desired species. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and control of undesirable vegetation are suitable management practices.

This soil is well suited to woodland. Upland oaks and yellow poplar are the dominant native trees. Species preferred for planting include yellow poplar, sweetgum, black walnut, white ash, loblolly pine, and cherrybark oak. Management concerns include the hazard of erosion, the equipment limitation, and plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for woodland wildlife.

This soil is poorly suited to most urban uses. The slope is the main limitation. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill.

This soil is in capability subclass VIe.

MmD3—Memphis silt loam, 12 to 30 percent slopes, severely eroded. This very deep, well drained, moderately steep or steep soil is on upland side slopes throughout the county. Individual areas range from about 3 to 241 acres in size. Erosion has removed most of the original surface layer and in places has removed some of the subsoil. Some areas have rills and shallow gullies.

Typically, the surface layer is dark yellowish brown silt loam about 2 inches thick. The subsoil extends to a depth of about 63 inches. It is silt loam. The upper part is strong brown, and the lower part is brown. The substratum to a depth of about 84 inches is yellowish red silt loam.

This soil is low in natural fertility and organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is fair. The soil crusts and becomes cloddy if worked when the moisture content is too high. The root zone is very deep and can be easily penetrated by plant roots.

Included with this soil in mapping are small areas of Loring, Nicholson, and Zanesville soils. These soils are in landscape positions similar to those of the Memphis soil. Included areas make up less than 5 percent of this map unit. They are generally less than 3 acres in size.

Most areas of the Memphis soil are used for pasture. Some areas are idle land or are wooded.

This soil is not suited to row crops and small grain.

This soil is suited to pasture and hay. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Frequent pasture renovation helps to maintain the desired species. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and control of undesirable vegetation are suitable management practices.

This soil is well suited to woodland. Upland oaks and yellow poplar are the dominant native trees. Species preferred for planting include yellow poplar, sweetgum, black walnut, white ash, loblolly pine, and cherrybark oak. Management concerns include the hazard of erosion, the equipment limitation, and plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for woodland wildlife.

This soil is poorly suited to most urban uses. The slope is the main limitation. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill.

This soil is in capability subclass VIIe.

Na—Nelse loam, frequently flooded. This very deep, well drained, nearly level soil is on flood plains along the major rivers in the county. Slopes are uniform and range from 0 to 2 percent. Individual areas range from about 4 to 477 acres in size.

Typically, the surface layer is dark brown loam about 18 inches thick. The substratum extends to a depth of about 60 inches. It is dark brown fine sandy loam in the upper part, light yellowish brown loamy fine sand in the next part, and yellowish brown, stratified silt loam and loamy fine sand in the lower part.

This soil is high in natural fertility and organic matter content. Permeability is moderately rapid or rapid, and the available water capacity is moderate. Tilth is good. The soil can be worked throughout a wide range in moisture content. The root zone is very deep and can be easily penetrated by plant roots. The soil is frequently flooded for brief periods.

Included with this soil in mapping are small areas of Huntington and Nolin soils. These soils are in landscape positions similar to those of the Nelse soil. Included areas make up less than 10 percent of this map unit. They are generally less than 3 acres in size.

Most areas of the Nelse soil are used for row crops. Some areas are wooded.

This soil is well suited to row crops. Small grain can often be damaged by the flooding. Good tilth can be easily maintained by implementing crop residue management techniques.

This soil is suited to pasture and hay, but the flooding is a management concern in areas used for hay. Applications of fertilizer, control of weeds and brush, and rotation grazing are suitable management practices.

This soil is well suited to woodland. Species preferred for planting include green ash, sweetgum, and American sycamore. The main management concerns are the equipment limitation and plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is poorly suited to most urban uses. The flooding is the main limitation affecting building site development and sanitary facilities. The rapid permeability also is a limitation on sites for most kinds of sanitary facilities.

This soil is in capability subclass IIw.

Nb—Nelse-Huntington complex, frequently flooded. This map unit consists of very deep, well drained, nearly level soils on flood plains along the major rivers in the county. Slopes range from 0 to 2 percent. Individual areas range from about 3 to 84 acres in size. They are about 60 percent Nelse soil and 25 percent Huntington soil.

Typically, the surface layer of the Nelse soil is dark brown loam about 18 inches thick. The substratum extends to a depth of about 60 inches. It is dark brown fine sandy loam in the upper part, light yellowish brown loamy fine sand in the next part, and yellowish brown, stratified silt loam and loamy fine sand in the lower part.

The Nelse soil is high in natural fertility and organic matter content. Permeability is moderately rapid or rapid, and the available water capacity is moderate. Tilth is good. The soil can be cultivated throughout a wide range in moisture content. The root zone is very deep and can be easily penetrated by plant roots. The soil is frequently flooded for brief periods.

Typically, the surface layer of the Huntington soil is dark brown silt loam about 13 inches thick. The subsoil extends to a depth of about 70 inches. It is silt loam. The upper part is dark grayish brown, and the lower part is brown. The substratum to a depth of about 84 inches is brown, stratified silt loam, loam, and fine sand.

The Huntington soil is high in natural fertility and organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is good. The soil can be worked throughout a wide range in moisture content. The root zone is very deep. The soil is frequently flooded for brief periods.

Included with these soils in mapping are small areas of Nolin soils. These included soils are in landscape positions similar to those of the Nelse and Huntington soils. Also included are small areas that have short slopes of as much as 20 percent. Included areas make up less than 15 percent of this map unit. They are generally less than 3 acres in size.

Most areas of the Nelse and Huntington soils are used for row crops. A few areas are used for pasture or woodland.

These soils are well suited to row crops. Small grain may be damaged by the flooding. Good tilth can be easily maintained by implementing crop residue management techniques.

These soils are suited to hay and pasture. Applications of fertilizer, control of weeds and brush, rotation grazing, and proper stocking rates are suitable management practices. Hay crops may be damaged in some years by the flooding.

These soils are well suited to woodland. Species preferred for planting include yellow poplar, black walnut, northern red oak, loblolly pine, and eastern white pine on the Huntington soil and green ash, sweetgum, and American sycamore on the Nelse soil. The main management concerns are plant competition on the Huntington soil and the equipment limitation and plant competition on the Nelse soil. See table 7 for specific information relating to potential productivity.

These soils are well suited to habitat for openland and woodland wildlife.

These soils are poorly suited to urban uses. The flooding is the main limitation.

These soils are in capability subclass IIw.

NcE—Nelse-Huntington-Wheeling complex, 2 to 55 percent slopes, frequently flooded. This map unit consists of very deep, well drained soils in long, narrow areas adjacent to the Ohio, Cumberland, and Tennessee Rivers. The Nelse soil is in gently sloping to steep areas adjacent to the rivers and generally has slopes ranging from 2 to 25 percent. The Huntington soil is in gently sloping to moderately steep areas on bottom land adjacent to the rivers and generally has slopes ranging from 2 to 15 percent. The Wheeling soil is on the steeper, clifflike banks and has slopes ranging from 20 to 55 percent. Individual areas of this map unit are about 150 to 350 feet wide and several hundred feet long. They range from about 4 to 155 acres in size. They are about 35 percent Nelse soil, 35 percent Huntington soil, and 20 percent Wheeling soil.

Typically, the surface layer of the Nelse soil is dark brown loam about 18 inches thick. The substratum extends to a depth of about 60 inches. The upper part is dark brown fine sandy loam. The next part is light yellowish brown loamy fine sand. The lower part is yellowish brown, stratified silt loam and loamy fine sand.

The Nelse soil is high in natural fertility and organic matter content. Permeability is moderately rapid or rapid, and the available water capacity is moderate. The root zone is very deep. The soil is frequently flooded for brief to long periods.

Typically, the surface layer of the Huntington soil is dark brown silt loam about 13 inches thick. The subsoil extends to a depth of about 70 inches. It is silt loam. It is dark grayish brown in the upper part and brown in the lower part. The substratum to a depth of about 84 inches is brown, stratified silt loam, loam, and fine sand.

The Huntington soil is high in natural fertility and organic matter content. Permeability is moderate, and the available water capacity is high. The root zone is very deep. The soil is frequently flooded for brief to long periods.

Typically, the surface layer of the Wheeling soil is brown silt loam about 9 inches thick. The subsoil extends to a depth of about 57 inches. It is strong brown silt loam in the upper part and strong brown loam in the lower part. The substratum extends to a depth of about 96 inches. The upper part is strong brown loam, and the lower part is strong brown and brownish yellow, stratified loam and sandy loam.

The Wheeling soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and the available water capacity is high. The root zone is very deep and can be easily penetrated by plant roots. The soil is subject to rare flooding.

Included with these soils in mapping are areas of soils that are stratified with sand, silt, and clay. Also included are areas of mixed, undifferentiated sediments on steep banks along streams that drain into the rivers. Included areas make up about 10 percent of this map unit. They are generally less than 5 acres in size.

Most areas of the Nelse, Huntington, and Wheeling soils are wooded.

These soils are not suited to crops and hay. The major limitations are the frequent flooding and the slope.

These soils are best suited to a permanent cover of grasses and trees that can withstand the frequent flooding. Grasses and legumes, such as Kentucky 31 fescue, reed canarygrass, and alsike clover, should be selected for planting because they are deep rooted and can tolerate the seasonal flooding.

These soils are poorly suited to woodland. Common trees include black willow, American sycamore, and river birch. Establishing trees on the steeper banks helps to minimize the cutting action of the swift river currents during winter and spring floods.

These soils are well suited to habitat for woodland wildlife. The Nelse and Huntington soils also are well suited to habitat for openland wildlife.

These soils are poorly suited to urban uses. The slope and the flooding are the main limitations.

These soils are in capability subclass VIe.

Ne—Newark silt loam, frequently flooded. This very deep, somewhat poorly drained, nearly level soil is on flood plains along the major streams and rivers. Individual areas range from about 3 to 247 acres in size. Some areas are dissected by small streams and drainage ditches. Slopes range from 0 to 2 percent.

Typically, the surface layer is brown silt loam about 7 inches thick. The subsoil extends to a depth of about 37 inches. It is yellowish brown, mottled silt loam in the upper part and light brownish gray, mottled silty clay loam in the lower part. The upper part of the substratum is grayish brown, mottled silt loam. The lower part to a depth of about 60 inches is grayish brown, mottled silty clay.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is good. The root zone is very deep and can be easily penetrated by plant roots. A seasonal high water table is at a depth of 0.5 foot to 1.5 feet. The soil is frequently flooded for brief periods.

Included with this soil in mapping are small areas of Lindside, Melvin, and Nolin soils. These soils are in landscape positions similar to those of the Newark soil. Included areas make up less than 5 percent of this map unit. They are less than 3 acres in size.

Most areas of the Newark soil have been cleared and are used for row crops (fig. 11). A few small areas support native hardwoods.

This soil is well suited to row crops. The wetness and the flooding are limitations. Small grain may be damaged by the flooding. Good tilth can be maintained by implementing crop residue management techniques. Planting and harvesting may be delayed in some years because of the seasonal wetness and the flooding.

This soil is suited to pasture and hay, but the frequent flooding and the wetness are management concerns. Artificial drainage, control of weeds, rotation grazing, and applications of fertilizer and lime are suitable management practices. Hay crops may be damaged in some years by the flooding.

This soil is well suited to woodland. Species preferred for planting include eastern cottonwood, sweetgum, American sycamore, and green ash. Management concerns include the equipment limitation, seedling mortality, and plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for woodland wildlife.

This soil is poorly suited to most urban uses. The flooding and the wetness are the main limitations. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill.

This soil is in capability subclass IIw.

NhC—Nicholson silt loam, 6 to 12 percent slopes. This very deep, moderately well drained, sloping soil is on upland side slopes throughout the county. It has a fragipan. Individual areas range from about 3 to 76 acres in size.

Typically, the surface layer is dark yellowish brown silt loam about 7 inches thick. The subsoil extends to a depth of about 60 inches. The upper part is strong brown silt loam. The next part is a firm, brittle, compact fragipan of strong brown, mottled silt loam. The lower part is yellowish brown silty clay.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate above the fragipan and slow in the fragipan. The available water capacity is moderate. Tilth is good. The soil can be cultivated throughout a wide range in moisture content. The root zone is moderately deep. A perched high water table is at a depth of 1.5 to 2.5 feet in late winter and early spring.

Included with this soil in mapping are small areas of Hammack, Loring, and Memphis soils. These soils are in landscape positions similar to those of the Nicholson

Figure 11.—Soybeans in an area of Newark silt loam, frequently flooded.

soil. Also included are small areas of severely eroded Nicholson soils. Included areas make up less than 10 percent of the map unit. They are less than 2 acres in size.

Most areas of the Nicholson soil are used for row crops or pasture and hay.

This soil is suited to most of the row crops commonly grown in the area. The hazard of erosion is severe if conventional tillage methods are used. Conservation tillage, contour farming, and stripcropping help to control erosion and runoff. Crop residue management helps to maintain good tilth. The fragipan restricts the penetration of roots and the downward movement of air and water.

This soil is well suited to pasture and hay. The fragipan limits the growth of deep-rooted plants, such as alfalfa. Applications of fertilizer and lime, control of weeds and brush, rotation grazing, and proper stocking rates are suitable management practices.

This soil is suited to woodland. Species preferred for planting include white oak, northern red oak, yellow poplar, sweetgum, eastern white pine, white ash, and loblolly pine. The main management concerns are the hazard of erosion and plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is poorly suited to most urban uses. The wetness is the main limitation affecting most kinds of building site development and sanitary facilities. The slow permeability also is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design

and installation can help to overcome these limitations.
This soil is in capability subclass IIIe.

NhC3—Nicholson silt loam, 6 to 12 percent slopes, severely eroded. This very deep, moderately well drained, sloping soil is on upland side slopes throughout the county. It has a fragipan. Individual areas range from about 4 to 175 acres in size. Erosion has removed most of the original surface layer and in places has removed some of the subsoil. Some areas have rills and shallow gullies.

Typically, the surface layer is yellowish brown silt loam about 6 inches thick. The subsoil extends to a depth of about 56 inches. The upper part is yellowish brown silt loam. The next part is a firm, brittle, compact fragipan of yellowish brown, mottled silt loam. The lower part is red, mottled silty clay loam. The substratum to a depth of about 68 inches is red silty clay.

This soil is low in natural fertility and organic matter content. Permeability is moderate above the fragipan and slow in the fragipan. The available water capacity is moderate. Tilth is fair. The soil crusts and becomes cloddy if cultivated when the moisture content is too high. The root zone is shallow to moderately deep. The fragipan restricts the penetration of roots and the downward movement of air and water. A perched high water table is at a depth of 1.5 to 2.5 feet in late winter and early spring.

Included with this soil in mapping are small areas of Hammack, Loring, Memphis, and Zanesville soils. These soils are in landscape positions similar to those of the Nicholson soil. Included areas make up less than 10 percent of this map unit. They are less than 2 acres in size.

Most areas of the Nicholson soil are used for pasture and hay. A few areas are used for row crops.

This soil is suited to limited production of row crops. The hazard of erosion is very severe if conventional tillage methods are used. Contour farming, stripcropping, and conservation tillage help to control runoff and erosion. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence. The fragipan restricts the downward movement of water and causes the soil to dry slowly in the spring.

This soil is suited to pasture and hay. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Applications of fertilizer and lime, control of weeds and brush, rotation grazing, and proper stocking rates are suitable management practices.

This soil is suited to woodland. Species preferred for planting include white ash, white oak, eastern white pine, and loblolly pine. The main management concerns are the hazard of erosion and plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is poorly suited to most urban uses. The wetness is the main limitation affecting most kinds of building site development and sanitary facilities. The slow permeability also is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IVe.

NhD—Nicholson silt loam, 12 to 20 percent slopes. This very deep, moderately well drained, moderately steep soil is on upland side slopes throughout the county. It has a fragipan. Individual areas range from about 4 to 60 acres in size.

Typically, the surface layer is dark yellowish brown silt loam about 7 inches thick. The subsoil extends to a depth of about 60 inches. The upper part is strong brown silt loam. The next part is a firm, brittle, compact fragipan of strong brown, mottled silt loam. The lower part is yellowish brown silty clay.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate above the fragipan and slow in the fragipan. The available water capacity is moderate. The root zone is moderately deep. Tilth is good. The soil can be cultivated throughout a wide range in moisture content. A perched high water table is at a depth of 1.5 to 2.5 feet in late winter and early spring.

Included with this soil in mapping are small areas of Hammack, Loring, and Memphis soils. These soils are in landscape positions similar to those of the Nicholson soil. Also included are small areas of severely eroded Nicholson soils. Included areas make up about 10 percent of this map unit. They are less than 2 acres in size.

Most areas of the Nicholson soil are used for row crops or pasture and hay.

This soil is suited to most of the row crops commonly grown in the area. The hazard of erosion is very severe if conventional tillage methods are used. Contour farming, stripcropping, and conservation tillage help to control runoff and erosion. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence. The fragipan restricts the penetration of roots and the downward movement of air and water.

This soil is suited to hay and pasture. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Frequent pasture renovation helps to maintain the desired species. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and control of undesirable vegetation are suitable management practices.

This soil is suited to woodland. Upland oaks and hickory are the dominant native trees. Species preferred for planting include white oak, northern red oak, yellow poplar, white ash, sweetgum, eastern white pine, and loblolly pine. Management concerns include the hazard of erosion, the equipment limitation, and plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for woodland wildlife.

This soil is poorly suited to most urban uses. The slope and the wetness are the main limitations affecting most kinds of building site development and sanitary facilities. The slow permeability also is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IVe.

NhD3—Nicholson silt loam, 12 to 20 percent slopes, severely eroded. This very deep, moderately well drained, moderately steep soil is on upland side slopes throughout the county. It has a fragipan. Individual areas range from about 3 to 95 acres in size. Erosion has removed most of the original surface layer and in places has removed some of the subsoil. Some areas have rills and shallow gullies.

Typically, the surface layer is yellowish brown silt loam about 6 inches thick. The subsoil extends to a depth of about 56 inches. The upper part is yellowish brown silt loam. The next part is a firm, brittle, compact fragipan of yellowish brown, mottled silt loam. The lower part is red, mottled silty clay loam. The substratum to a depth of about 68 inches is red silty clay.

This soil is low in natural fertility and organic matter content. Permeability is moderate above the fragipan and slow in the fragipan. The available water capacity is moderate. Tilth is fair. The soil crusts and becomes cloddy if cultivated when the moisture content is too high. The root zone is shallow to moderately deep. The fragipan restricts the penetration of roots and the downward movement of air and water. A perched high water table is at a depth of 1.5 to 2.5 feet in late winter and early spring.

Included with this soil in mapping are small areas of Hammack, Loring, Memphis, and Zanesville soils. These soils are in landscape positions similar to those of the Nicholson soil. Included areas make up less than 10 percent of this map unit. They are less than 2 acres in size.

Most areas of the Nicholson soil are used for pasture and hay. A few areas are idle land or are wooded.

This soil is not suited to row crops. It is suited to pasture and hay. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Applying fertilizer and lime, controlling weeds and brush, rotation grazing, and proper stocking rates are suitable management practices.

This soil is suited to woodland. Upland oaks, hickory, and maple are the dominant native trees. Species preferred for planting include white oak, eastern white pine, white ash, and loblolly pine. The main management concerns are the hazard of erosion and plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for woodland wildlife.

This soil is poorly suited to most urban uses. The slope and the wetness are the main limitations affecting most kinds of building site development and sanitary facilities. The slow permeability also is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass VIe.

No—Nolin silt loam, frequently flooded. This very deep, well drained, nearly level soil is on flood plains throughout the county. Individual areas range from about 3 to 230 acres in size. Some areas are dissected by drainage ditches and small streams. Slopes range from 0 to 2 percent.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of about 40 inches. It is silt loam. The upper part is dark yellowish brown, and the lower part is brown. The substratum to a depth of about 72 inches is yellowish brown silty clay loam.

This soil is high in natural fertility and moderate in organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is good. The soil can be cultivated throughout a wide range in moisture content. The root zone is very deep and can be easily penetrated by plant roots. A high water table is at a depth of 3 to 6 feet. The soil is frequently flooded for brief periods.

Included with this soil in mapping are small areas of

Huntington, Lindside, Nelse, and Newark soils. These soils are in landscape positions similar to those of the Nolin soil. Also included are small areas that have a surface layer of fine sandy loam. Included areas make up less than 10 percent of this map unit. They are less than 2 acres in size.

Most areas of the Nolin soil are used for row crops. A few areas are wooded.

This soil is well suited to row crops. Small grain can often be damaged by the flooding. Good tilth can be maintained by implementing crop residue management techniques.

This soil is well suited to pasture and hay. Applications of fertilizer, control of weeds, and rotation grazing are suitable management practices. Hay crops can be damaged in some years by the flooding.

This soil is well suited to woodland. Species preferred for planting include black walnut, yellow poplar, cherrybark oak, eastern white pine, eastern cottonwood, sweetgum, and pin oak. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is suited to habitat for openland and woodland wildlife.

This soil is poorly suited to most urban uses. The flooding is the main limitation. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill.

This soil is in capability subclass IIw.

OtB—Otwell silt loam, 2 to 6 percent slopes. This very deep, moderately well drained, gently sloping soil is on stream terraces throughout the county. It has a fragipan. Individual areas range from about 3 to 190 acres in size.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of about 51 inches. The upper part is strong brown silt loam. The next part is strong brown silty clay loam. The lower part is a very firm, brittle, compact fragipan of yellowish brown, mottled silt loam and brown, mottled silty clay loam. The substratum to a depth of about 67 inches is brown, mottled silt loam.

This soil is medium in natural fertility and low in organic matter content. Permeability is moderately slow above the fragipan and very slow in the fragipan. The available water capacity is moderate. Tilth is good. The soil can be worked throughout a wide range in moisture content. The root zone is moderately deep. The fragipan restricts the penetration of roots and the downward movement of air and water. A perched high water table is at a depth of 1.5 to 2.5 feet.

Included with this soil in mapping are small areas of Elk, Henshaw, Licking, and Wheeling soils. These soils are in landscape positions similar to those of the Otwell soil. Also included are small areas of severely eroded Otwell soils. Included areas make up less than 5 percent of this map unit. They are less than 2 acres in size.

Most areas of the Otwell soil are used for row crops. A few small areas support native hardwoods.

This soil is well suited to row crops. The hazard of erosion is moderate if conventional tillage methods are used. Conservation tillage and contour farming help to control erosion and runoff. The growth of deep-rooted crops is limited because of the fragipan and the seasonal high water table. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence.

This soil is suited to pasture and hay. Applications of fertilizer, rotation grazing, and control of brush and weeds are suitable management practices.

This soil is suited to woodland. Species preferred for planting include yellow poplar, white ash, eastern white pine, and loblolly pine. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is poorly suited to most urban uses. The wetness is the main limitation affecting most kinds of building site development and sanitary facilities. The slow permeability also is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IIe.

OtC3—Otwell silt loam, 6 to 12 percent slopes, severely eroded. This very deep, moderately well drained, sloping soil is on stream terraces throughout the county. Individual areas range from about 4 to 55 acres in size. Erosion has removed most of the original surface layer and in places has removed some of the subsoil. Some areas have rills and shallow gullies.

Typically, the surface layer is yellowish brown silt loam about 3 inches thick. The subsoil extends to a depth of about 59 inches. The upper part is yellowish brown silt loam. The lower part is a very firm, brittle, compact fragipan of strong brown, mottled silt loam. The substratum to a depth of about 84 inches is yellowish brown, mottled silt loam.

This soil is low in natural fertility and organic matter content. Permeability is moderately slow above the fragipan and very slow in the fragipan. The available water capacity is moderate. Tilth is fair. The root zone is shallow to moderately deep. The fragipan restricts the penetration of roots and the downward movement of water. A perched high water table is at a depth of 1.5 to 2.5 feet.

Included with this soil in mapping are small areas of Elk, Henshaw, Licking, and McGary soils. These soils are in landscape positions similar to those of the Otwell soil. Included areas make up about 10 percent of this map unit. They are less than 3 acres in size.

Most areas of the Otwell soil are used for pasture and hay. A few small areas are used for row crops.

This soil is suited to limited production of row crops. The hazard of erosion is very severe if conventional tillage methods are used. Contour farming, stripcropping, and conservation tillage help to control runoff and erosion. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence.

This soil is suited to hay and pasture. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and weed control help to maintain the desired plants. The growth of deep-rooted plants, such as alfalfa, is limited because of the fragipan and the seasonal high water table.

This soil is suited to woodland. Species preferred for planting include yellow poplar, white ash, eastern white pine, and loblolly pine. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is poorly suited to most urban uses. The wetness and the slope are the main limitations affecting most kinds of building site development and sanitary facilities. The slow permeability also is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IVe.

Pe—Peoga silt loam. This very deep, poorly drained, nearly level soil is on stream terraces along the larger streams. Individual areas range from about 3 to 136 acres in size. Some areas are dissected by drainage ditches. Slopes range from 0 to 2 percent.

Typically, the surface layer is grayish brown silt loam about 6 inches thick. The subsoil extends to a depth of about 62 inches. It is light brownish gray and grayish brown, mottled silt loam in the upper part; light olive gray and light olive brown, mottled silty clay loam in the next part; and yellowish brown, mottled loam in the lower part.

This soil is medium in natural fertility and low in organic matter content. Permeability is slow, and the available water capacity is high. Tilth is good. The root zone is very deep. A seasonal high water table is within a depth of 1 foot.

Included with this soil in mapping are small areas of Henshaw, McGary, Melvin, and Otwell soils. These soils are in landscape positions similar to those of the Peoga soil. Also included are small areas of soils that are similar to the Peoga soil but have a weak fragipan. Included areas make up less than 10 percent of this map unit. They are less than 2 acres in size.

Most areas of the Peoga soil are used for row crops. A few areas are used for pasture, or they support native hardwoods.

Where this soil has been drained, it is suited to row crops. Planting and harvesting may be delayed in some years because of the seasonal wetness. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence.

Where this soil has been drained, it is suited to pasture and hay. Plants that can tolerate the seasonal wetness should be selected for planting. Applications of fertilizer, proper stocking rates, rotation grazing, and weed control are suitable management practices.

This soil is suited to woodland. Species preferred for planting include baldcypress, green ash, sweetgum, and pin oak. Management concerns include the equipment limitation, seedling mortality, and plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for wetland wildlife and is suited to habitat for openland and woodland wildlife.

This soil is poorly suited to most urban uses. The wetness is the main limitation. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill.

This soil is in capability subclass IIIw.

Pt—Pits, quarries. This map unit consists of areas that have been quarried for limestone. The soil and several feet of bedrock have been removed (fig. 12). The remaining pits are 10 to 60 feet deep. Sandstone or limestone bedrock has been exposed in the pits. The bedrock supports little or no vegetation. Individual areas of this map unit range from about 4 to 608 acres in size.

Included in mapping are loading and access areas

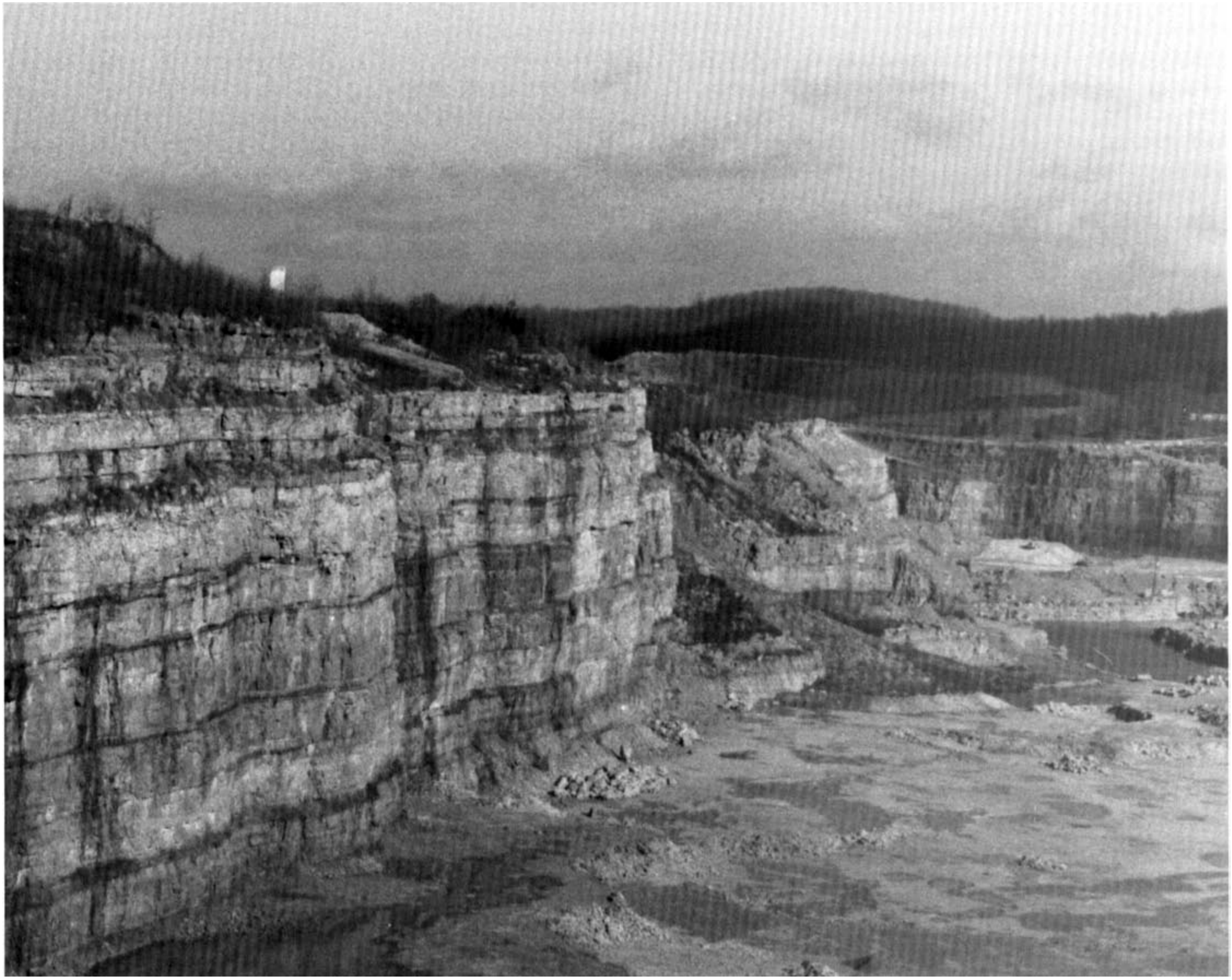

Figure 12.—Limestone mining at one of Livingston County's quarries.

where the soil material has been removed or covered with broken pieces of bedrock. These areas are adjacent to the pits. Also included are areas of active and inactive gravel pits.

This map unit is in capability subclass VIIIs.

Pu—Pits-Udorthents complex. This map unit consists of areas of material that has been mixed in the process of mining, mostly fluorspar mining. Most areas are along fault lines in the uplifted face of limestone formations of the Mississippian age. Shallow ponds partially filled with sand and silt and scattered piles of rock fragments are in some areas. Waste piles of soil material and rock fragments that are moderately steep or steep are in most areas. A few areas have vertical wall faces as a result of previous mining. Individual areas of this map unit range from about 3 to 637 acres in size.

Included in mapping are areas of cut and fill material from construction of the Barkley and Kentucky Dams. Also included, in the Grand Rivers area, are areas of stockpiled limestone and coal.

Most areas have not been reclaimed. Vegetation includes grasses, forbs, and mixed hardwoods.

This map unit is in capability subclass VIIs.

SaE—Saffell gravelly silt loam, 20 to 40 percent slopes. This very deep, well drained, steep or very steep soil is on upland side slopes, mainly south of the Cumberland River. Individual areas range from about 3 to 749 acres in size. Most areas are dissected by intermittent drains.

Typically, the surface layer is brown gravelly silt loam about 8 inches thick. The subsoil extends to a depth of about 54 inches. It is yellowish brown very gravelly silt loam in the upper part, strong brown extremely gravelly clay loam and extremely gravelly sandy clay loam in the next part, and yellowish red, mottled extremely gravelly sandy clay loam in the lower part. The substratum to a depth of about 72 inches is yellowish red extremely gravelly sandy loam.

This soil is low in natural fertility and organic matter content. Permeability and the available water capacity are moderate. The root zone is very deep but is restricted because of the extremely gravelly and compact subsoil.

Included with this soil in mapping are small areas of Baxter, Brandon, and Hammack soils in landscape positions similar to those of the Saffell soil. Included areas make up less than 10 percent of this map unit. They are less than 5 acres in size.

Most areas of the Saffell soil are used for pasture or woodland. A few areas are used as sources of commercial gravel.

This soil is not suited to row crops. It is suited to pasture. The slope and the severe hazard of erosion are the main limitations. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Frequent pasture renovation helps to maintain the desired species. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and control of undesirable vegetation are suitable management practices.

This soil is suited to woodland. Upland oaks and hickory are the dominant native trees. Species preferred for planting include white oak, loblolly pine, and shortleaf pine. Management concerns include the hazard of erosion, the equipment limitation, seedling mortality, and plant competition. Steep skid trails and firebreaks are subject to rilling and gullying unless they are provided with adequate water bars or are protected by plant cover, or both. The slope restricts the use of wheeled and tracked equipment on skid trails. Cable yarding is generally safer and results in less disturbance of the surface layer. The seedling mortality rate may be high in summer because of inadequate moisture in the soil. Competition from undesirable plants can hinder natural or artificial reforestation. Intensive site preparation and maintenance may be needed. See table 7 for specific information relating to potential productivity.

This soil is suited to habitat for woodland wildlife.

This soil is poorly suited to urban uses. The slope is the main limitation affecting most kinds of building site development and sanitary facilities. Seepage also is a limitation on sites for some kinds of sanitary facilities.

This soil is in capability subclass VIIe.

WfE—Wellston-Frondorf silt loams, very rocky, 20 to 50 percent slopes. These very deep or moderately deep, well drained soils are on steep or very steep hillsides, mainly north of the Cumberland River. Many areas are dissected by small drains. Individual areas range from about 3 to 797 acres in size. They are about 40 percent Wellston soil and 30 percent Frondorf soil. Sandstone rock outcrops make up about 5 percent.

Typically, the surface layer of the Wellston soil is brown silt loam about 6 inches thick. The subsoil extends to a depth of about 45 inches. It is yellowish brown silt loam in the upper part, strong brown silty clay loam in the next part, and brown silt loam in the lower part. Sandstone bedrock is at a depth of about 45 inches.

The Wellston soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and the available water capacity is high. The root zone is deep or very deep. The depth to bedrock ranges from 40 to 72 inches.

Typically, the surface layer of the Frondorf soil is dark brown silt loam about 2 inches thick. The subsurface layer is yellowish brown gravelly silt loam about 6 inches thick. The subsoil is about 29 inches thick. It is yellowish brown silt loam and silty clay loam in the upper part and strong brown gravelly silt loam and very channery silty clay loam in the lower part. Sandstone bedrock is at a depth of about 37 inches.

The Frondorf soil is low in natural fertility and moderate in organic matter content. Permeability and the available water capacity are moderate. The root zone and the depth to bedrock range from 20 to 40 inches.

Included with these soils in mapping are small areas of Faywood, Lowell, and Zanesville soils. These included soils are in landscape positions similar to those of the Wellston and Frondorf soils. Also included are small areas of soils that are shallow over bedrock and small areas of Wellston and Frondorf soils that have boulders on the surface. Included areas make up about 25 percent of this map unit. They are generally less than 10 acres in size.

Most areas of the Wellston and Frondorf soils are wooded.

These soils are poorly suited to pasture and row crops because of the slope, the hazard of erosion, and the rock outcrops.

These soils are suited to woodland. Upland oaks, hickory, and maple are the dominant native trees. Species preferred for planting include eastern white pine, black walnut, yellow poplar, northern red oak, white ash, white oak, loblolly pine, and shortleaf pine. Management concerns include the hazard of erosion, the equipment limitation, seedling mortality, and plant competition. The slope restricts the use of wheeled equipment on skid trails. Cable yarding is generally safer and results in less disturbance of the surface layer. Competition from undesirable plants can hinder natural or artificial reforestation. Intensive site preparation and maintenance may be needed. See table 7 for specific information relating to potential productivity and appropriate trees to plant on warm and cool aspects of these soils.

These soils are well suited to habitat for woodland wildlife.

These soils are poorly suited to urban uses. The slope and the depth to bedrock are the main limitations.

These soils are in capability subclass VIIe.

WhA—Wheeling silt loam, 0 to 2 percent slopes. This very deep, well drained, nearly level soil is on stream terraces along the Cumberland, Ohio, and Tennessee Rivers. Individual areas are long and are narrow to broad. They range from about 3 to 51 acres in size.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of about 57 inches. It is strong brown silt loam in the upper part and strong brown loam in the lower part. The substratum extends to a depth of about 96 inches. It is strong brown loam in the upper part and strong brown and brownish yellow, stratified loam and sandy loam in the lower part.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is good. The soil can be cultivated throughout a wide range in moisture content. The root zone is very deep and can be easily penetrated by plant roots.

Included with this soil in mapping are small areas of Chavies, Elk, and Otwell soils. These soils are in landscape positions similar to those of the Wheeling soil. Included areas make up less than 10 percent of this map unit. They are less than 2 acres in size.

Most areas of the Wheeling soil are used for row crops. A few areas are used for hay and pasture.

This soil is well suited to all of the row crops commonly grown in the area. Because the soil has good natural drainage and warms up early in the spring, it is well suited to landscape nursery plants and several specialty vegetable crops. Applying a system of crop residue management and growing cover crops help to maintain soil structure, tilth, and organic matter content.

This soil is well suited to hay and pasture. Applications of fertilizer and lime, control of weeds, rotation grazing, and proper stocking rates are suitable management practices.

This soil is well suited to woodland. Species preferred for planting include eastern white pine, yellow poplar, black walnut, northern red oak, white oak, and loblolly pine. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is well suited to most urban uses. Seepage is the main limitation affecting most kinds of sanitary facilities. Proper design and installation can help to overcome this limitation.

This soil is in capability class I.

WhB—Wheeling silt loam, 2 to 6 percent slopes. This very deep, well drained, gently sloping soil is on stream terraces along the Cumberland, Ohio, and Tennessee Rivers. Individual areas range from about 4 to 239 acres in size.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of about 57 inches. It is strong brown silt loam in the upper part and strong brown loam in the lower part. The substratum extends to a depth of about 96 inches. It is strong brown loam in the upper part and strong brown and brownish yellow, stratified loam and sandy loam in the lower part.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is good. The soil can be cultivated throughout a wide range in moisture content. The root zone is very deep and can be easily penetrated by plant roots.

Included with this soil in mapping are small areas of Chavies, Elk, and Otwell soils. These soils are in landscape positions similar to those of the Wheeling soil. Included areas make up less than 10 percent of this map unit. They are less than 2 acres in size.

Most areas of the Wheeling soil are used for row crops. A few areas are used for hay and pasture.

This soil is well suited to all of the row crops commonly grown in the area. Because the soil has good natural drainage and warms up early in the spring, it is well suited to landscape nursery plants and several specialty vegetable crops. The hazard of erosion is moderate if conventional tillage methods are used. Applying a system of conservation tillage, implementing crop residue management techniques, and growing cover crops help to control erosion and runoff.

This soil is well suited to hay and pasture. Applications of fertilizer and lime, weed control, rotation grazing, and proper stocking rates are suitable management practices.

This soil is well suited to woodland. Species preferred for planting include eastern white pine, yellow poplar, black walnut, northern red oak, white oak, and loblolly pine. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is well suited to most urban uses. Seepage is the main limitation on sites for most kinds of sanitary facilities.

This soil is in capability subclass IIe.

WhC—Wheeling silt loam, 6 to 12 percent slopes. This very deep, well drained, sloping soil is on stream terraces along the Cumberland, Ohio, and Tennessee Rivers. Individual areas range from about 3 to 99 acres in size.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of about 57 inches. It is strong brown silt loam in the upper part and strong brown loam in the lower part. The substratum extends to a depth of about 96 inches. It is strong brown loam in the upper part and strong brown and brownish yellow, stratified loam and sandy loam in the lower part.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is good. The soil can be cultivated throughout a wide range in moisture content. The root zone is very deep and can be easily penetrated by plant roots.

Included with this soil in mapping are small areas of Chavies, Elk, and Otwell soils. These soils are in landscape positions similar to those of the Wheeling soil. Included areas make up less than 10 percent of this map unit. They are less than 2 acres in size.

Most areas of the Wheeling soil are used for row crops. A few areas are used for hay and pasture.

This soil is well suited to all of the row crops commonly grown in the area. Because the soil has good natural drainage and warms up early in the spring, it is well suited to landscape nursery crops and several specialty vegetable crops. The hazard of erosion is severe if conventional tillage methods are used. Applying a system of conservation tillage, implementing crop residue management techniques, growing cover crops, and including grasses and legumes in the cropping sequence help to control erosion and maintain tilth and organic matter content.

This soil is well suited to hay and pasture. Applications of fertilizer and lime, control of weeds and brush, rotation grazing, and proper stocking rates are suitable management practices.

This soil is well suited to woodland. Species preferred for planting include eastern white pine, yellow poplar, black walnut, northern red oak, white oak, and loblolly pine. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is suited to most urban uses. The slope is the main limitation affecting most kinds of building site development and sanitary facilities. Seepage also is a limitation on sites for some kinds of sanitary facilities. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IIIe.

WhD—Wheeling silt loam, 12 to 20 percent slopes. This very deep, well drained, moderately steep soil is on stream terraces along the Cumberland, Ohio, and Tennessee Rivers. Individual areas range from about 3 to 136 acres in size.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of about 57 inches. It is strong brown silt loam in the upper part and strong brown loam in the lower part. The substratum extends to a depth of about 96 inches. It is strong brown loam in the upper part and strong brown and brownish yellow, stratified loam and sandy loam in the lower part.

This soil is medium in natural fertility and moderate in organic matter content. Permeability is moderate, and the available water capacity is high. Tilth is good. The soil can be cultivated throughout a wide range in moisture content. The root zone is very deep and can be easily penetrated by plant roots.

Included with this soil in mapping are small areas of Chavies, Elk, and Otwell soils. These soils are in landscape positions similar to those of the Wheeling soil. Included areas make up less than 10 percent of this map unit. They are less than 2 acres in size.

Most areas of the Wheeling soil are used for pasture and hay.

This soil is suited to limited production of row crops. The hazard of erosion is very severe if conventional tillage methods are used. Contour farming, stripcropping, and conservation tillage help to control runoff and erosion. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence.

This soil is well suited to hay and pasture. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Frequent pasture renovation helps to maintain the desired species. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and control of undesirable vegetation are suitable management practices.

This soil is well suited to woodland. Species preferred for planting include eastern white pine, yellow poplar, black walnut, northern red oak, white oak, and loblolly pine. The main management concerns are plant competition, the hazard of erosion, and the equipment limitation. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for woodland wildlife.

This soil is poorly suited to most urban uses. The slope is the main limitation affecting most kinds of building site development and sanitary facilities. Seepage also is a limitation on sites for some kinds of sanitary facilities. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IVe.

ZaC—Zanesville silt loam, 6 to 12 percent slopes. This very deep, well drained or moderately well drained, sloping soil is on upland ridgetops and side slopes in the central and northern parts of the county. It has a fragipan. Individual areas range from about 5 to 61 acres in size.

Typically, the surface layer is dark yellowish brown silt loam about 5 inches thick. The subsoil extends to a depth of about 50 inches. The upper part is yellowish brown and strong brown silt loam. The next part is a very firm, brittle, compact fragipan of strong brown and brown, mottled silt loam. The lower part is brown, mottled silt loam. The substratum to a depth of about 65 inches is dark yellowish brown, mottled silt loam. Sandstone bedrock is at a depth of about 65 inches.

This soil is medium in natural fertility and low in organic matter content. Permeability is moderate above the fragipan and slow in the fragipan. The available water capacity is moderate. Tilth is good. The soil can be tilled throughout a wide range in moisture content. The root zone is moderately deep. Roots can readily penetrate the soil above the fragipan. A perched high water table is at a depth of 2 to 3 feet. The depth to bedrock ranges from 40 to 80 inches.

Included with this soil in mapping are small areas of Frondorf and Loring soils. These soils are in landscape positions similar to those of the Zanesville soil. Also included are small areas of severely eroded Zanesville soils. Included areas make up less than 15 percent of this map unit. They are generally less than 3 acres in size.

Most areas of the Zanesville soil are used for row crops. A few areas are used for hay and pasture or are wooded.

This soil is suited to most of the row crops and small grain commonly grown in the area. The hazard of erosion is severe if conventional tillage methods are used. Contour farming, stripcropping, and conservation tillage help to control runoff and erosion. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence.

This soil is well suited to hay and pasture. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Frequent pasture renovation helps to maintain the desired species. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and control of undesirable vegetation are suitable management practices.

This soil is suited to woodland. Species preferred for planting include yellow poplar, white ash, northern red oak, eastern white pine, and shortleaf pine. The main management concern is plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is poorly suited to most urban uses. The wetness and the slope are the main limitations affecting building site development and sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IIIe.

ZaC3—Zanesville silt loam, 6 to 12 percent slopes, severely eroded. This very deep, well drained or moderately well drained, sloping soil is on upland side slopes in the central and northern parts of the county. It has a fragipan. Individual areas range from about 3 to 500 acres in size. Erosion has removed most of the original surface layer and in places has removed some of the subsoil. Some areas have rills and shallow gullies.

Typically, the surface layer is brown silt loam about 5 inches thick. The subsoil extends to a depth of about 39 inches. The upper part is brown silt loam and strong brown silty clay loam. The next part is a brittle, firm, compact fragipan of brown, mottled silt loam. The lower part is strong brown, mottled silt loam. The substratum to a depth of about 68 inches is strong brown and brown, mottled silt loam.

This soil is low in natural fertility and organic matter content. Permeability is moderate above the fragipan and slow in the fragipan. The available water capacity is moderate. Tilth is fair. The soil crusts and becomes cloddy unless cultivated within a suitable range in moisture content. The root zone is shallow to moderately deep. The fragipan restricts the penetration of roots and the downward movement of water. A perched high water table is at a depth of 2 to 3 feet. The depth to bedrock ranges from 40 to 80 inches.

Included with this soil in mapping are small areas of Frondorf and Loring soils. These soils are in landscape positions similar to those of the Zanesville soil. Also included are small areas of Zanesville soils that are not eroded. Included areas make up less than 15 percent of this map unit. They are generally less than 3 acres in size.

Most areas of the Zanesville soil are used for row crops. A few areas are used for hay and pasture or are wooded. A few small areas support second growth trees or are idle land.

This soil is suited to limited production of row crops and small grain. The hazard of erosion is very severe if conventional tillage methods are used. Contour farming, stripcropping, and conservation tillage help to control runoff and erosion. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence.

This soil is suited to hay and pasture (fig. 13). Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Applications of fertilizer and lime, control of weeds and brush, rotation grazing, and proper stocking rates are suitable management practices.

This soil is suited to woodland. Species preferred for planting include Virginia pine, shortleaf pine, white oak, and eastern white pine. The main management concern is seedling mortality. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for openland and woodland wildlife.

This soil is poorly suited to most urban uses. The wetness and the slope are the main limitations affecting building site development and sanitary facilities. The slow permeability also is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IVe.

ZaD—Zanesville silt loam, 12 to 20 percent slopes. This very deep, well drained or moderately well drained, moderately steep soil is on upland side slopes in the central and northern parts of the county. It has a fragipan. Individual areas range from about 3 to 148 acres in size.

Typically, the surface layer is dark yellowish brown silt loam about 5 inches thick. The subsoil extends to a depth of about 50 inches. The upper part is yellowish brown and strong brown silt loam. The next part is a very firm, brittle, compact fragipan of strong brown and brown, mottled silt loam. The lower part is brown, mottled silt loam. The substratum to a depth of about 65 inches is dark yellowish brown silt loam. Sandstone bedrock is at a depth of about 65 inches.

This soil is medium in natural fertility and low in organic matter content. Permeability is moderate above the fragipan and slow in the fragipan. The available water capacity is moderate. Tilth is good. The root zone is moderately deep. Roots can readily penetrate the soil above the fragipan. A perched high water table is at a depth of 2 to 3 feet. The depth to bedrock ranges from 40 to 80 inches.

Included with this soil in mapping are small areas of Frondorf and Loring soils. These soils are in landscape positions similar to those of the Zanesville soil. Also included are small areas of severely eroded Zanesville soils. Included areas make up less than 15 percent of this map unit. They are generally less than 3 acres in size.

Most areas of the Zanesville soil are used for row crops or hay and pasture. Some areas are wooded.

This soil is suited to limited production of row crops. The hazard of erosion is very severe if conventional tillage methods are used. Contour farming, stripcropping, and conservation tillage help to control runoff and erosion. Tilth and the organic matter content can be maintained or improved by implementing crop residue management techniques and including grasses and legumes in the cropping sequence.

This soil is suited to pasture and hay. Plants that produce adequate forage and provide satisfactory ground cover should be selected for planting. Frequent pasture renovation helps to maintain the desired species. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and control of undesirable vegetation are suitable management practices.

This soil is well suited to woodland. Upland oaks and hickory are the dominant native trees. Species preferred

Figure 13.—Hay in an area of Zanesville silt loam, 6 to 12 percent slopes, severely eroded.

for planting include yellow poplar, white ash, white oak, northern red oak, eastern white pine, and shortleaf pine. Management concerns include the hazard of erosion, the equipment limitation, and plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for woodland wildlife.

This soil is poorly suited to most urban uses. The slope and the wetness are the main limitations affecting most kinds of building site development and sanitary facilities. The slow permeability also is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass IVe.

ZaD3—Zanesville silt loam, 12 to 20 percent slopes, severely eroded. This very deep, well drained or moderately well drained, moderately steep soil is on upland side slopes in the central and northern parts of the county. It has a fragipan. Individual areas range from about 3 to 224 acres in size. Erosion has removed most of the original surface layer and in places has removed some of the subsoil. Some areas have rills and shallow gullies.

Typically, the surface layer is brown silt loam about 5 inches thick. The subsoil extends to a depth of about 39 inches. The upper part is brown silt loam and strong brown silty clay loam. The next part is a brittle, firm, compact fragipan of brown, mottled silt loam. The lower part is strong brown, mottled silt loam. The substratum to a depth of about 68 inches is strong brown and brown, mottled silt loam.

This soil is low in natural fertility and organic matter content. Permeability is moderate above the fragipan and slow in the fragipan. The available water capacity is moderate. Tilth is fair. The soil crusts and becomes cloddy unless cultivated within a suitable range in moisture content. The root zone is shallow to moderately deep. Roots can easily penetrate the soil above the fragipan but are restricted in the fragipan. A perched high water table is at a depth of 2 to 3 feet. The depth to bedrock ranges from 40 to 80 inches.

Included with this soil in mapping are small areas of Frondorf and Loring soils. These soils are in landscape positions similar to those of the Zanesville soil. Also included are small areas of Zanesville soils that are not eroded. Included areas make up less than 15 percent of this map unit. They are generally less than 3 acres in size.

Most areas of the Zanesville soil are used for hay and pasture. Some areas are wooded.

This soil is poorly suited to row crops. It is suited to pasture and hay. Plant mixtures that produce adequate forage, provide satisfactory ground cover, and require the least amount of renovation should be selected for planting. Applications of lime and fertilizer, proper stocking rates, rotation grazing, and control of undesirable vegetation are suitable management practices.

This soil is suited to woodland. Upland oaks are the dominant native trees. Species preferred for planting include white oak, Virginia pine, shortleaf pine, and eastern white pine. Management concerns include the hazard of erosion, the equipment limitation, and plant competition. See table 7 for specific information relating to potential productivity.

This soil is well suited to habitat for woodland wildlife.

This soil is poorly suited to most urban uses. The slope and the wetness are the main limitations affecting most kinds of building site development and sanitary facilities. The slow permeability also is a limitation on sites for some kinds of sanitary facilities. Low strength is a limitation on sites for local roads and streets. It is also a concern if the soil is used as a source of roadfill. Proper design and installation can help to overcome these limitations.

This soil is in capability subclass VIe.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to food, feed, forage, fiber, and oilseed crops. Such soils have properties that favor the economic production of sustained high yields of crops. The soils need only to be treated and managed by using acceptable farming methods. The moisture supply must be adequate, and the growing season must be sufficiently long. Prime farmland soils produce the highest yields with minimal expenditure of energy and economic resources. Farming these soils results in the least damage to the environment.

Prime farmland soils may presently be used as cropland, pasture, or woodland or for other purposes. They either are used for food or fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land 10 acres or more in size that is used for such purposes as housing, industrial, and commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water-control structures. Public land is land not available for farming in national forests, national parks, military reservations, and state parks.

Prime farmland soils usually receive an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent.

The soils in Livingston County that are considered prime farmland are listed at the end of this section. The location of each map unit is shown on the detailed soil maps at the back of this publication. The extent of each unit is given in table 4. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

Some soils that have a high water table and all soils that are frequently flooded during the growing season qualify as prime farmland only in areas where these limitations have been overcome by drainage or flood-control measures. If applicable, the need for these measures is indicated in parentheses after the map unit name in the following list. Onsite evaluation is necessary to determine if the limitations have been overcome by corrective measures.

The soils identified as prime farmland in Livingston County are:

AsA	Ashton silt loam, 0 to 4 percent slopes, occasionally flooded
ChB	Chavies fine sandy loam, 2 to 6 percent slopes
Du	Dunning silty clay, frequently flooded (where drained and either protected from flooding or not frequently flooded during the growing season)
EkA	Elk silt loam, 0 to 2 percent slopes
EkB	Elk silt loam, 2 to 6 percent slopes
Hn	Henshaw silt loam, rarely flooded (where drained)
Hu	Huntington silt loam, frequently flooded (where protected from flooding or not frequently flooded during the growing season)
Ka	Karnak silty clay, frequently flooded (where drained and either protected from flooding or not frequently flooded during the growing season)
LcB	Licking silt loam, 2 to 6 percent slopes

Ln Lindside silt loam, frequently flooded (where protected from flooding or not frequently flooded during the growing season)
LoB Loring silt loam, 2 to 6 percent slopes
Mc McGary silt loam, rarely flooded (where drained)
Me Melvin silt loam, frequently flooded (where drained and either protected from flooding or not frequently flooded during the growing season)
MmB Memphis silt loam, 2 to 6 percent slopes
Na Nelse loam, frequently flooded (where protected from flooding or not frequently flooded during the growing season)
Nb Nelse-Huntington complex, frequently flooded (where protected from flooding or not frequently flooded during the growing season)
Ne Newark silt loam, frequently flooded (where drained and either protected from flooding or not frequently flooded during the growing season)
No Nolin silt loam, frequently flooded (where protected from flooding or not frequently flooded during the growing season)
OtB Otwell silt loam, 2 to 6 percent slopes
Pe Peoga silt loam (where drained)
WhA Wheeling silt loam, 0 to 2 percent slopes
WhB Wheeling silt loam, 2 to 6 percent slopes

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in the survey area. The survey can help planners to maintain or create a land use pattern that is in harmony with nature.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Kentucky Cooperative Extension Service.

Cropland

In 1988, about 40,000 acres in Livingston County was cropland. Of this total, 17,300 acres was used for row crops, mainly corn and soybeans; 18,700 acres was used for alfalfa and other hay crops; and about 4,000 acres was used for close-growing crops, mainly wheat *(11)*.

The potential of the soils for increased production is high. Additional acreage is available for future crop production. About 17,000 acres of potentially good cropland is wooded, and about 22,000 acres is used for pasture *(21)*. Production can also be increased by applying the latest crop production technology to all of the cropland in the survey area. This soil survey can facilitate the application of such technology. For example, the paragraphs that follow describe the management needed on the cropland in the survey area.

Water erosion is a major concern on all cropland and pasture where slopes exceed 2 percent. Ashton, Baxter, Brandon, Chavies, Elk, Faywood, Frondorf, Hammack, Licking, Loring, Lowell, Memphis, Nicholson, Otwell, Saffell, Wellston, Wheeling, and Zanesville soils have slopes of more than 2 percent.

Loss of the surface layer reduces fertility and the available water capacity and results in poor tilth. Erosion is especially harmful on soils that have a layer in or below the subsoil that limits the depth of the root zone, such as Faywood, Frondorf, Loring, Nicholson, Otwell, and Zanesville soils. Controlling erosion minimizes the pollution of streams by sedimentation and thus improves the quality of water for municipal and recreational uses and for fish and wildlife.

In many sloping fields, tilling or preparing a good

Figure 14.—No-till corn planted in sod in an area of Loring silt loam, 2 to 6 percent slopes.

seedbed is difficult because of the loss of the original friable surface soil. No-till planting is effective in controlling erosion on sloping land (fig. 14). Generally, erosion-control measures provide a protective cover of crop residue or vegetation, help to control runoff, and increase the rate of water infiltration. Applying a conservation tillage system that leaves a vegetative cover on the surface throughout the year helps to control erosion and maintains the productivity of the soil. On livestock farms, a cropping system that includes legumes and grass forage crops helps to control erosion on sloping land, provides nitrogen, and improves tilth for subsequent crops.

Information regarding the design of erosion-control measures for each kind of soil is available in local offices of the Soil Conservation Service.

Wetness is the main management concern on the somewhat poorly drained or poorly drained soils that are used for crops and pasture. Dunning, Henshaw, Karnak, McGary, Melvin, Newark, and Peoga soils are examples. These soils make up about 19,100 acres. Most areas used for crops have been artificially drained.

Natural soil fertility is medium in most of the soils in the uplands. Some soils on flood plains, such as Dunning, Huntington, Lindside, Nolin, Newark, and Nelse soils, have higher levels of natural plant nutrients and are less acid than most of the soils in the uplands.

Many of the soils in the uplands are naturally strongly acid or very strongly acid. If lime has never been added to these soils, ground limestone is needed to raise the pH level sufficiently for optimum yields of alfalfa and other crops that grow best on nearly neutral soils. Levels of available phosphorus and potash are naturally low in most of these soils. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Kentucky Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime needed.

Soil tilth and crop residue left on the surface influence the germination of seeds, the rate of water infiltration, and the content of organic matter. Specific information is provided in the section "Detailed Soil Map Units."

Most of the soils in the county that are used for crops have a surface layer of silt loam that has a light color and a low organic matter content. The structure of these soils generally is weak, and heavy rainfall causes a crust to form on the surface. This crust is hard when dry and is nearly impervious to water. Once the crust forms, it reduces infiltration and increases runoff. Regularly adding crop residue, manure, and other organic material to the soil improves soil structure and minimizes the formation of crusts.

Field crops, such as corn and soybeans, are the most common row crops. Others that are suited to the soils and climate of the county include many that are not commonly grown. The production of grain sorghum, popcorn, sunflowers, navy beans, sugar beets, peanuts, potatoes, and similar crops can be increased if economic conditions are favorable.

Wheat is the most common close-growing crop. Barley, rye, oats, buckwheat, fescue, red clover, orchardgrass, bromegrass, and timothy can also be grown. The production of these crops can be increased if economic conditions are favorable.

A small acreage of specialty crops is grown commercially. These include garden crops, such as tomatoes and sweet corn; tree fruits, such as apples and peaches; and other crops, such as strawberries and nursery plants. Large areas can also be adapted to other specialty crops, such as blueberries, grapes, and other vegetables that are not commonly grown in the county.

Deep soils that have good natural drainage and that warm up early in spring are well suited to many vegetables and small fruits. Examples are Chavies, Elk, Memphis, and Wheeling soils that have slopes of less than 6 percent (fig. 15). These soils make up about 6,100 acres. Crops can generally be planted and harvested earlier on these soils than on other soils in the county. These soils are also well suited to sweet potatoes, head cabbage, cauliflower, broccoli, muskmelons, peanuts, and watermelons.

Most of the well drained soils are suitable for orchards and nursery plants; however, soils in low positions on the landscape where frost is frequent and air drainage is poor are generally poorly suited to early vegetables, small fruits, and orchards. Local offices of the Soil Conservation Service and the Kentucky Cooperative Extension Service can provide the latest information regarding specialty crops.

Generally, soils that are well suited to crops are also well suited to urban development. Data about specific soils in the county can be used in planning future land use patterns. The potential productive capacity in farming should be weighed against soil limitations and the potential for nonfarm development.

Pasture and Hayland

In 1988, there were about 17,000 beef and dairy cattle in Livingston County *(21)*. Most of the pasture and hayland supports a mixture of grasses and legumes. About 80 percent of the hayland is used in a rotational hay and pasture system. Most of the harvested hay is rolled into large bales.

Approximately 75,000 acres in the county is used for hay and pasture. According to National Resource Inventory estimates, treatment is needed on 37 percent of the pastureland and 48 percent of the cropland, including hayland. Treatment includes implementing erosion-control measures, protecting the soils from overgrazing, selecting adapted forage plants, improving soil fertility, managing brush, and controlling weeds and insects.

About 62 percent of the total farm cash receipts in the county is from livestock. Consequently, a high-quality forage program is important.

The soils in the county vary widely in their ability to produce forage because of differences in depth to bedrock or limiting layers, internal drainage, available water capacity, and many other properties. Selecting the plant species or mixture of species appropriate to the specific soil helps to realize the greatest returns and the maximum soil and water conservation.

Additional information about pasture and hayland management is available at the local office of the Soil Conservation Service or the Kentucky Cooperative Extension Service.

Figure 15.—Specialty crops on Chavies fine sandy loam, 2 to 6 percent slopes, and Wheeling silt loam, 2 to 6 percent slopes. Supplemental irrigation increases production on these soils.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Kentucky Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for use as cropland. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit *(18)*. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode, but they have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless a close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

Charles A. Foster, forester, Soil Conservation Service, helped prepare this section.

Soils vary in their ability to produce trees. Available water capacity and depth of the root zone have major effects on tree growth. Fertility and texture also influence tree growth. Elevation, aspect, and climate determine the kinds of trees that can grow on a site. Elevation and aspect are of particular importance in mountainous areas.

This soil survey can be used by woodland managers planning ways to increase the productivity of forest land. Some soils respond better to applications of fertilizer than others, and some are more susceptible to landslides and erosion after roads are built and timber is harvested. Some soils require special reforestation efforts. In the section "Detailed Soil Map Units," the description of each map unit in the survey area suitable for timber includes information about productivity, limitations in harvesting timber, and management concerns in producing timber. Table 7 summarizes this forestry information and rates the soils for a number of factors to be considered in management. *Slight, moderate,* and *severe* are used to indicate the degree of the major soil limitations to be considered in forest management.

Ratings of the *erosion hazard* indicate the probability that damage may occur if site preparation or harvesting activities expose the soil. The risk is *slight* if no particular preventive measures are needed under ordinary conditions; *moderate* if erosion-control measures are needed for particular silvicultural activities; and *severe* if special precautions are needed to control erosion for most silvicultural activities. Ratings of moderate or severe indicate the need for construction of higher standard roads, additional maintenance of roads, additional care in planning harvesting and reforestation activities, or the use of special equipment.

Ratings of *equipment limitation* indicate limits on the use of forest management equipment, year-round or seasonal, because of such soil characteristics as slope, wetness, stoniness, or susceptibility of the surface layer to compaction. As slope gradient and length increase, it becomes more difficult to use wheeled equipment. On the steeper slopes, tracked equipment is needed. On the steepest slopes, even tracked equipment cannot be operated and more sophisticated systems are needed. The rating is *slight* if equipment use is restricted by soil wetness for less than 2 months and if special equipment is not needed. The rating is *moderate* if slopes are so steep that wheeled equipment cannot be operated safely across the slope, if wetness restricts equipment use from 2 to 6 months per year, if stoniness restricts the use of ground-based equipment, or if special equipment is needed to prevent or minimize compaction. The rating is *severe* if slopes are so steep that tracked equipment cannot be operated safely across the slope, if wetness restricts equipment use for more than 6 months per year, if stoniness restricts the use of ground-based equipment, or if special equipment is needed to prevent or minimize compaction. Ratings of moderate or severe indicate a need to choose the most suitable equipment and to carefully plan the timing of harvesting and other management activities.

Ratings of *seedling mortality* refer to the probability of the death of naturally occurring or properly planted seedlings of good stock in periods of normal rainfall, as influenced by kinds of soil or topographic features. Seedling mortality is caused primarily by too much water or too little water. The factors used in rating a soil for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, rooting depth, and the aspect of the slope. The mortality rate generally is highest on soils that have a sandy or clayey surface layer. The risk is *slight* if, after site preparation, expected mortality is less than 25 percent; *moderate* if expected mortality is between 25 and 50 percent; and *severe* if expected mortality exceeds 50 percent. Ratings of moderate or severe indicate that it may be necessary to use containerized or larger than usual planting stock or to make special site preparations, such as bedding, furrowing, installing a surface drainage system, and providing artificial shade for seedlings. Reinforcement planting is often needed if the risk is moderate or severe.

Ratings of *plant competition* indicate the likelihood of the growth or invasion of undesirable plants. Plant competition is more severe on the more productive soils, on poorly drained soils, and on soils having a restricted root zone that holds moisture. The risk is *slight* if competition from undesirable plants hinders adequate natural or artificial reforestation but does not necessitate intensive site preparation and maintenance. The risk is *moderate* if competition from undesirable plants hinders natural or artificial reforestation to the extent that intensive site preparation and maintenance are needed. The risk is *severe* if competition from undesirable plants prevents adequate natural or artificial reforestation unless the site is intensively prepared and maintained. A moderate or severe rating indicates the need for site preparation to ensure the development of an adequately stocked stand. Managers must plan site preparation measures to ensure reforestation without delays.

The *potential productivity* of *common trees* on a soil is expressed as a *site index* and a *volume* number. Common trees are listed in the order of their observed general occurrence. Generally, only two or three tree species dominate. The first tree listed for each soil is the indicator species for that soil. An indicator species is a tree that is common in the area and that is generally the most productive on a given soil.

The *site index* is determined by taking height measurements and determining the age of selected trees within stands of a given species. This index is the average height, in feet, that the trees attain in a specified number of years. This index applies to fully stocked, even-aged, unmanaged stands. The estimates of the productivity of the soils in this survey are based on published data *(4, 5, 6, 7, 8, 9, 10, 15, 16)*.

The *volume* is the yield likely to be produced by the most important trees, expressed in cubic feet per acre per year calculated at the age of culmination of mean annual increment.

Trees to plant are those that are used for reforestation or, under suitable conditions, natural regeneration. They are suited to the soils and can produce a commercial wood crop. The desired product, topographic position (such as a low, wet area), and personal preference are three factors among many that can influence the choice of trees for use in reforestation.

Commercial forest land in Livingston County makes up 40 percent of the land area, or 79,100 acres *(12)*. The dominant forest types are oak-hickory on approximately 45 percent of the forest land, central mixed hardwoods on 26 percent, elm-ash-cottonwood on 18 percent, oak-gum-cypress on 8 percent, and white oak on 3 percent.

Woodland tracts in the county are generally small, private holdings of about 24 acres and are essentially unmanaged. Most of the forest land is capable of growing 50 cubic feet or more of wood per acre per year, but actual growth is about 33 cubic feet per acre per year.

Several obstacles exist in managing private forest land. For example, 30 percent of the landowners have forest land simply because it is part of the farm or tract. Also, many stands are not well stocked with desirable, high-quality trees, and many tracts are owned for less than 10 years before resale.

With proper management, tree quality and stocking patterns can be improved. Removing low-quality trees from fully stocked or understocked stands of all sizes and regenerating sawtimber stands after harvest are suitable management practices.

The wood industry in the county consists primarily of commercial sawmills that produce rough lumber, dimension stock, crossties, and lumber chips. The county also supplies logs and standing trees to several mills in adjacent counties.

Recreation

Recreation is an important land use in Livingston County. Lake Barkley and Kentucky Lake are in the most southern part of Livingston County. Each year these lakes attract thousands of tourists who are interested in fishing, water sports, and camping. Grand Rivers, which is also located in the southern part of the county, is a major tourist attraction because of its proximity to the two lakes.

In table 8, the soils of the survey area are rated according to the limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have gentle slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes, stones, or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Gregory K. Johnson, resource specialist, Soil Conservation Service, helped prepare this section.

The principal kinds of wildlife in Livingston County are cottontail rabbits, gray squirrels, fox squirrels, raccoons, opossums, skunks, red foxes, gray foxes, white-tailed deer, muskrats, bobwhite quail, mourning doves, ducks, and geese. There also are many species of nongame birds and mammals.

Photographers, birdwatchers, and others are especially interested in wildlife. Five species that frequent the county have been declared endangered by the U.S. Fish and Wildlife Service. These are the Indiana bat, gray bat, bald eagle, American peregrine falcon, and Bachman's warbler.

The streams of the county contain a variety of warm-water game fish, pan fish, and other fish that are common throughout the state. Examples of these are largemouth bass and bluegill.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, orchardgrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are partridge pea, purpletop, bluestem, switchgrass, goldenrod, and beggarweed.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, and blackberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian olive, autumn olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine and redcedar.

Wetland plants are annual and perennial, wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, cattail, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds. Examples of aquatic plants that grow in these areas are cattails, buttonbush, willows, sedges, reeds, and arrowhead.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, red fox, and mourning dove.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the "Glossary."

Building Site Development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer, stone content, soil texture, and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. Depth to a high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, depth to a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost-action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, depth to a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 11 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and that good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, depth to a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, depth to a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, depth to a water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and releases a variety of plant nutrients as it decomposes.

Water Management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives the restrictive features that affect each soil for drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20, or higher, for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate, or component, consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence the shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of movement of water through the soil when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage in each major soil layer is stated in inches of water per inch of soil. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion. Losses are expressed in tons per acre per year. These estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur over a sustained period without affecting crop productivity. The rate is expressed in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep or very deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep, deep, or very deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflowing streams, by runoff from adjacent slopes, or by inflow from high tides. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in swamps and marshes or in a closed depression is considered ponding.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely to occur.

Frequency, duration, and probable dates of occurrence are estimated. Frequency generally is expressed as *none, rare, occasional,* or *frequent. None* means that flooding is not probable. *Rare* means that flooding is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year). *Occasional* means that flooding occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year). *Frequent* means that flooding occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 days to 1 month), and *very long* (more than 1 month). The time of year that floods are most likely to occur is expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely, thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons characteristic of soils that are not subject to flooding.

Also considered is local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is highest. A water table that is seasonally high for less than 1 month is not indicated in table 16.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Two numbers in the column showing depth to the water table indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. "More than 6.0" indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severely corrosive environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture,acidity, and the amount of sulfates in the saturation extract.

Physical and Chemical Analyses of Selected Soils

The results of physical analysis of several typical pedons in the survey area are given in table 17 and the results of chemical analysis in table 18. The data are for soils sampled at carefully selected sites. The pedons are typical of the series and are described in the section "Soil Series and Their Morphology." Soil samples were analyzed by the Kentucky Agricultural Experiment Station, Lexington, Kentucky.

Most determinations, except those for grain-size analysis and bulk density, were made on soil material smaller than 2 millimeters in diameter. Measurements reported as percent or quantity of unit weight were calculated on an oven-dry basis. The methods used in obtaining the data are indicated in the list that follows. The codes in parentheses refer to published methods *(20)*.

Rock fragments—(2-19 mm fraction) weight estimates of the percentages of all materials less than 19 mm (3B1).

Rock fragments—(2 mm fraction) volume estimate of the percentage of all materials greater than 2 mm (3B2).

Sand—(0.05-2.0 mm fraction) weight percentages of materials less than 2 mm (3A1).

Silt—(0.002-0.05 mm fraction) pipette extraction, weight percentages of all materials less than 2 mm (3A1).

Clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of materials less than 2 mm (3A1).

Water retained—pressure extraction, percentage of oven-dry weight of less than 2 mm material; ⅓ or 1/10 (3/10) bar (4B1), 15 bars (4B2).

Organic carbon—dichromate, ferric sulfate titration (6A1a).

Extractable cations—ammonium acetate pH 7.0, uncorrected; calcium (6N2), magnesium (6O2), sodium (6P2), potassium (6Q2).

Extractable acidity—potassium chloride-triethanolamine (6H3a).

Cation-exchange capacity—ammonium acetate, pH 7.0 (5A1a).

Cation-exchange capacity—sum of cations (5A3a).

Base saturation—ammonium acetate, pH 7.0 (5C1).

Base saturation—sum of cations, TEA, pH 8.2 (5C3).

Reaction (pH)—1:1 water dilution (8C1a).

Carbonate as calcium carbonate—manometric (6E1b).

Available phosphorus—Procedure (656), Kentucky Agricultural Experiment Station.

Calcium carbonate equivalent—Procedure (236b), USDA

Handbook 60, USDA Salinity Laboratory 1954 (6N7).

Engineering Index Test Data

Table 19 shows laboratory test data for two pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil Series and Their Morphology." The soil samples were tested by the Soil Mechanics Laboratory, Soil Conservation Service, South National Technical Center, Fort Worth, Texas.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM); and Specific gravity—D 854-91 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(19)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or on laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders, primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalf (*Ud*, meaning udic moisture regime, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalfs*, the suborder of the Alfisols that has a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, thermic Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. There can be some variation in the texture of the surface layer or of the substratum within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The location of these pedons are indicated by a special symbol on the soil maps. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(17)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(19)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Ashton Series

The Ashton series consists of very deep, well drained, moderately permeable soils on low stream terraces along the Cumberland, Ohio, and Tennessee

Rivers. These soils formed in loamy alluvium. Slopes range from 0 to 4 percent. The soils are fine-silty, mixed, mesic Mollic Hapludalfs.

The Ashton soils in this survey area are taxadjuncts to the series because they have a mollic epipedon, can have hue of 10YR in the Bt horizon, and display characteristics of Typic Argiudolls. These differences, however, do not affect use and management of the soils.

Ashton soils are commonly associated with Elk soils on stream terraces and with Huntington, Lindside, Newark, and Nolin soils on nearby flood plains. Elk soils have redder colors in the subsoil than the Ashton soils and do not have dark colors in the surface layer. Huntington, Nolin, Lindside, and Newark soils do not have an argillic horizon.

Typical pedon of Ashton silt loam, 0 to 4 percent slopes, occasionally flooded; about 7 miles due southeast of Smithland, 800 yards south of the intersection of Lucas Road and Kentucky Highway 453, about 100 yards north of the Tennessee River; on soil map sheet 27, east-west about 1,244,300 feet and north-south about 276,000 feet by the Kentucky coordinate grid system:

Ap—0 to 10 inches; dark brown (10YR 3/3) silt loam; weak fine granular and weak fine or medium subangular blocky structure; friable; common fine roots; few fine black concretions; neutral; clear smooth boundary.

Bt1—10 to 22 inches; dark brown (10YR 3/3) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; few distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; few fine black concretions; slightly acid; clear smooth boundary.

Bt2—22 to 30 inches; brown (7.5YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; very few fine roots; common prominent dark brown (10YR 3/3) clay films on faces of peds; few fine black concretions; slightly acid; gradual smooth boundary.

Bt3—30 to 57 inches; dark yellowish brown (10YR 3/4) silty clay loam; moderate medium and coarse subangular blocky structure; firm; very few fine roots; common distinct dark brown (10YR 3/3) clay films on vertical and horizontal faces of peds; common fine black concretions; slightly acid; gradual smooth boundary.

Bt4—57 to 60 inches; strong brown (7.5YR 4/6) silty clay loam; moderate medium subangular blocky structure; firm; common prominent dark brown (7.5YR 3/4) clay films on faces of peds; few fine black concretions; slightly acid.

The thickness of the solum ranges from 40 to 60 inches. The depth to bedrock is more than 5 feet. Reaction ranges from medium acid to neutral throughout the profile.

The Ap horizon has hue of 10YR, value of 3, and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is silt loam or silty clay loam.

Baxter Series

The Baxter series consists of very deep, well drained, moderately permeable, gravelly soils on upland side slopes. These soils formed in material weathered from cherty limestone. Slopes range from 20 to 50 percent. The soils are fine, mixed, mesic Typic Paleudalfs.

Baxter soils are associated on the landscape with Brandon, Hammack, and Loring soils. Brandon, Hammack, and Loring soils are fine-silty. Loring soils have a fragipan.

Typical pedon of Baxter gravelly silt loam, 20 to 50 percent slopes; about 5 miles due southwest of Salem, 134 yards southeast of Sandy Creek, 200 feet east of Cobb Road; on soil map sheet 18, east-west about 1,260,250 feet and north-south about 327,950 feet by the Kentucky coordinate grid system:

A—0 to 8 inches; yellowish brown (10YR 5/4) gravelly silt loam; weak fine granular structure; friable; common medium roots; about 18 percent chert fragments; medium acid; gradual wavy boundary.

BA—8 to 16 inches; yellowish brown (10YR 5/6) gravelly silt loam; weak medium subangular blocky structure; firm; few faint clay films on faces of peds; common fine and medium roots; about 20 percent chert fragments; strongly acid; gradual wavy boundary.

2Bt1—16 to 27 inches; red (2.5YR 5/8) very gravelly silty clay loam; few yellowish brown (10YR 5/6) streaks along old root channels; moderate medium subangular blocky structure; firm; few fine roots; few distinct clay films on faces of peds and on coarse fragments; about 40 percent chert fragments; few black stains; strongly acid; clear smooth boundary.

2Bt2—27 to 40 inches; red (10R 4/8) gravelly silty clay; few medium distinct yellowish brown (10YR 5/6) silt streaks; moderate medium subangular blocky structure; very firm; few very fine roots; common distinct clay films on faces of peds and on coarse fragments; about 30 percent chert fragments; very strongly acid; gradual wavy boundary.

2Bt3—40 to 64 inches; red (10R 4/8) gravelly clay; many medium distinct yellowish red (5YR 5/8) and strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; very firm; few fine roots; few distinct clay films on faces of peds; about 20 percent chert fragments; very strongly acid.

The thickness of the solum ranges from 60 to more than 120 inches. The depth to bedrock is more than 5 feet. In areas that have not been limed, reaction is very strongly acid or strongly acid throughout the profile. The content of chert fragments in the solum ranges from 15 to 45 percent.

The A horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. The BA horizon has hue of 10YR, 7.5YR, 5YR, or 2.5YR and value and chroma of 4 to 6. It is gravelly silt loam or gravelly silty clay loam. The Bt horizon, if it occurs, has hue of 5YR, 2.5YR, or 10R, value of 4 or 5, and chroma of 4 to 6. It is the gravelly or very gravelly analogs of silt loam or silty clay loam. The 2Bt horizon has hue of 10R, 2.5YR, or 5YR, value of 4 or 5, and chroma of 4 to 8. The lower part is mottled in shades of red, brown, olive, and gray. This horizon is the gravelly or very gravelly analogs of silty clay loam, silty clay, or clay.

Brandon Series

The Brandon series consists of very deep, well drained soils that are moderately permeable in the solum and moderately rapidly or rapidly permeable in the substratum. These soils formed in loess and in the underlying gravelly Coastal Plain material. They are on upland ridgetops and side slopes. Slopes range from 6 to 20 percent. The soils are fine-silty, mixed, thermic Typic Hapludults.

Brandon soils are associated on the landscape with Baxter, Loring, and Saffell soils. Baxter soils formed in material weathered from cherty limestone. They are fine textured. Loring soils have a fragipan. Saffell soils are loamy-skeletal.

Typical pedon of Brandon silt loam, 12 to 20 percent slopes, severely eroded; about 1.8 miles north of U.S. Highways 62 and 641 at Lake City, 0.3 mile northeast of the junction of Corinth Road and Kentucky Highway 453, about 330 yards north of Corinth Road; on soil map sheet 28, east-west about 1,266,100 feet and north-south about 270,250 feet by the Kentucky coordinate grid system:

Ap—0 to 5 inches; brown (10YR 5/3) silt loam; weak fine granular structure; very friable; common fine and medium roots; slightly acid; abrupt smooth boundary.

BE—5 to 10 inches; yellowish brown (10YR 5/6) silt loam; moderate thin platy structure; very friable; common fine and medium roots; dark gray (10YR 4/1) streaks along root channels; slightly acid; clear smooth boundary.

Bt1—10 to 21 inches; strong brown (7.5YR 5/6) silty clay loam; weak coarse subangular blocky structure; friable; common fine and medium roots; few light yellowish brown (10YR 6/4) streaks along root channels; few distinct brown (7.5YR 4/4) clay films on faces of peds; strongly acid; gradual wavy boundary.

Bt2—21 to 26 inches; strong brown (7.5YR 5/6) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; common grayish brown and brown silt coatings along root channels; moderate medium and coarse subangular blocky structure; firm; common fine and medium roots; few distinct brown (7.5YR 5/4) clay films on faces of peds; strongly acid; clear wavy boundary.

BC—26 to 36 inches; strong brown (7.5YR 5/6) silt loam; few fine distinct yellowish brown (10YR 5/8) and common coarse prominent light brownish gray (10YR 6/2) mottles; weak medium prismatic structure; firm; few fine roots; about 3 percent quartz gravel; strongly acid; gradual wavy boundary.

2C—36 to 60 inches; brown (7.5YR 5/4) very gravelly silt loam; few medium distinct light brownish gray (10YR 6/2) and few fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; few very fine roots; about 60 percent quartz gravel; strongly acid.

The thickness of the solum and of the loess mantle ranges from 20 to 40 inches. The depth to bedrock is more than 5 feet. The content of gravel ranges from 0 to 5 percent in the solum and from 30 to 60 percent in the 2C horizon. In areas that have not been limed, reaction is very strongly acid or strongly acid in the lower part of the profile.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The BE horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The Bt and BC horizons have hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. They are mottled in shades of brown and gray. They are silt loam or silty clay loam. The 2C horizon has hue of 7.5YR to 2.5YR, value of 4 or 5, and chroma of 4 to 6. It is mottled in shades of gray or brown. It is the gravelly or very gravelly analogs of silt loam, clay loam, or fine sandy loam.

Chavies Series

The Chavies series consists of very deep, well drained, moderately rapidly permeable soils on stream terraces. These soils formed in mixed alluvial material.

Slopes range from 2 to 20 percent. The soils are coarse-loamy, mixed, mesic Ultic Hapludalfs.

Chavies soils are associated on the landscape with Elk, Henshaw, Otwell, and Wheeling soils. Elk, Henshaw, and Otwell soils are fine-silty. Elk soils are on the lower stream terraces. Henshaw soils are somewhat poorly drained, and Otwell soils are moderately well drained. Wheeling soils are fine-loamy.

Typical pedon of Chavies fine sandy loam, 2 to 6 percent slopes; 1.2 miles due southwest of the west intersection of Rudd-Spees Road and U.S. Highway 60 in Ledbetter, 100 yards north of Chestnut Lake; on soil map sheet 25, east-west about 1,192,300 feet and north-south about 267,800 feet by the Kentucky coordinate grid system:

Ap—0 to 14 inches; dark brown (10YR 3/3) fine sandy loam; weak fine granular structure; very friable; common fine and medium roots; common fine mica flakes; neutral; clear smooth boundary.

Bt1—14 to 25 inches; yellowish brown (10YR 5/6) fine sandy loam; common medium distinct dark brown (10YR 3/3) mottles; weak medium subangular blocky structure parting to weak fine granular; friable; few fine and medium roots; few prominent brown (7.5YR 4/4) clay films on faces of peds; common fine mica flakes; neutral; clear smooth boundary.

Bt2—25 to 33 inches; strong brown (7.5YR 4/6) loam; moderate medium subangular blocky structure; firm; few fine and medium roots; common distinct brown (7.5YR 4/4) clay films on faces of peds; common fine mica flakes; neutral; clear smooth boundary.

Bt3—33 to 60 inches; strong brown (7.5YR 4/6) loam; light yellowish brown (10YR 6/4) vertical streaks less than 1 inch across; few medium distinct light yellowish brown (10YR 6/4) mottles in the lower part; moderate coarse subangular blocky structure parting to moderate medium subangular blocky; firm; few fine roots; common distinct brown (7.5YR 4/4) clay films on faces of peds; common fine mica flakes; medium acid.

The thickness of the solum ranges from 30 to 60 inches. The depth to bedrock is more than 5 feet. The content of gravel ranges from 0 to 15 percent in the solum and from 0 to 30 percent in the substratum. Reaction ranges from very strongly acid to neutral in the Ap horizon and the upper part of the Bt horizon and from very strongly acid to medium acid in the lower part of the Bt horizon and in the C horizon, if it occurs.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. The Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 to 6, and chroma of 3 to 6. It is mottled in shades of brown in the lower part. It is silt loam, loam, or fine sandy loam. The C horizon, if it occurs, has colors similar to those of the Bt horizon and is mottled in shades of brown. It is fine sandy loam, loam, loamy sand, sandy loam, or the gravelly analogs of these textures. It is commonly stratified.

Dunning Series

The Dunning series consists of very deep, poorly drained or very poorly drained, slowly permeable soils. These soils formed in clayey alluvial material. They are on flood plains. Slopes range from 0 to 2 percent. The soils are fine, mixed, mesic Fluvaquentic Haplaquolls.

Dunning soils are associated on the landscape with Lindside, Melvin, and Newark soils. Lindside, Melvin, and Newark soils are fine-silty and do not have a mollic epipedon.

Typical pedon of Dunning silty clay, frequently flooded; about 1.9 miles due northwest of Pinckneyville, 0.8 mile north of the Cumberland River, 600 yards south of Coff Road; on soil map sheet 18, east-west about 1,265,500 feet and north-south about 324,750 feet by the Kentucky coordinate grid system:

Ap—0 to 7 inches; very dark gray (10YR 3/1) silty clay; weak very fine granular structure; firm; slightly acid; abrupt smooth boundary.

Ag—7 to 21 inches; very dark gray (10YR 3/1) clay; moderate fine and medium angular blocky structure; very firm; mildly alkaline; clear smooth boundary.

Bg1—21 to 32 inches; dark gray (10YR 4/1) clay; few coarse faint light brownish gray (10YR 6/2) mottles; moderate fine subangular blocky structure; very firm; mildly alkaline; gradual smooth boundary.

Bg2—32 to 46 inches; gray (10YR 5/1) clay; few medium faint light brownish gray (10YR 6/2) mottles; weak fine subangular blocky structure; firm; mildly alkaline; gradual smooth boundary.

Cg—46 to 62 inches; dark gray (10YR 4/1) clay; many coarse faint very dark gray (10YR 3/1) mottles; massive; firm; mildly alkaline.

The thickness of the solum ranges from 30 to 50 inches. The depth to bedrock is more than 60 inches. The thickness of the mollic epipedon ranges from 10 to 24 inches. Reaction ranges from medium acid to mildly alkaline throughout the profile.

The Ap and Ag horizons have hue of 10YR, 2.5Y, or 5Y, value of 2 or 3, and chroma of 1 to 3 or are neutral in hue and have value of 2 or 3. The Bg horizon has hue of 7.5YR, 10YR, 2.5Y, or 5Y, value of 3 to 6, and chroma of 1 or 2 or is neutral in hue and has value of 2 or 3. It is mottled in shades of red, brown, olive, or gray. It is silty clay or clay. The Cg horizon has colors and textures similar to those of the Bg horizon.

Elk Series

The Elk series consists of very deep, well drained, moderately permeable soils on stream terraces. These soils formed in mixed loamy alluvial material. Slopes range from 0 to 12 percent. The soils are fine-silty, mixed, mesic Ultic Hapludalfs.

The Elk soils are commonly associated on the landscape with Ashton, Chavies, Henshaw, McGary, Otwell, and Wheeling soils on stream terraces and with Lindside, Newark, and Nolin soils on the lower flood plains. Ashton soils have a dark surface layer. Chavies soils are coarse-loamy. Otwell soils are moderately well drained, and Henshaw soils are somewhat poorly drained. McGary soils are somewhat poorly drained and are fine textured. Wheeling soils are fine-loamy. Nolin, Lindside, and Newark soils are on the lower flood plains. They do not have an argillic horizon.

Typical pedon of Elk silt loam, 2 to 6 percent slopes; about 1.1 miles southwest of the east intersection of Rudd-Spees Road and U.S. Highway 60 in Ledbetter, 0.3 mile north of the Tennessee River; on soil map sheet 25, east-west about 1,203,700 feet and north-south about 264,900 feet by the Kentucky coordinate grid system:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam; weak fine granular structure; friable; few fine and medium roots; few fine mica flakes; slightly acid; clear smooth boundary.

Bt1—9 to 16 inches; strong brown (7.5YR 5/6) silt loam; weak and moderate medium subangular blocky structure; firm; few fine roots; few distinct brown (7.5YR 4/4) clay films on faces of peds; few fine black concretions; few fine mica flakes; very strongly acid; gradual smooth boundary.

Bt2—16 to 35 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; very firm; few fine roots; common distinct brown (7.5YR 4/4) clay films on faces of peds; few fine black concretions; few black stains; few fine mica flakes; very strongly acid; clear smooth boundary.

Bt3—35 to 60 inches; strong brown (7.5YR 5/6) silty clay loam; common medium distinct light yellowish brown (10YR 6/4) and few medium distinct yellowish red (5YR 4/8) mottles; moderate medium subangular blocky structure; very firm; few distinct brown (7.5YR 4/4) clay films on faces of peds; few black stains; few fine mica flakes; very strongly acid; clear smooth boundary.

BC—60 to 76 inches; strong brown (7.5YR 4/6) silt loam; common medium distinct yellowish red (5YR 4/8), pale brown (10YR 6/3), and light yellowish brown (10YR 6/4) mottles; weak medium subangular blocky structure; firm; few distinct brown (7.5YR 4/4) clay films on faces of peds; few coarse black and brown stains; few fine mica flakes; very strongly acid; clear smooth boundary.

C—76 to 96 inches; brown (7.5YR 4/4) and strong brown (7.5YR 5/6) stratified silt loam and loam; few medium distinct light yellowish brown (10YR 6/4) mottles; coarse vertical pale brown (10YR 6/3) and light brownish gray (10YR 6/2) streaks; massive; firm; few fine mica flakes; strongly acid.

The thickness of the solum ranges from 40 to more than 76 inches. The depth to bedrock is more than 5 feet. In areas that have not been limed, reaction ranges from very strongly acid to slightly acid in the solum and from strongly acid to slightly acid in the substratum.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. It is mottled in shades of brown or red in the lower part. The BC and C horizons have colors similar to those of the Bt horizon. They are silt loam or loam.

Faywood Series

The Faywood series consists of moderately deep, well drained, moderately slowly permeable or slowly permeable soils that formed in limestone residuum interbedded with shale. These soils are on upland side slopes. Slopes range from 12 to 40 percent. The soils are fine, mixed, mesic Typic Hapludalfs.

Faywood soils are associated on the landscape with Frondorf, Lowell, and Wellston soils. Frondorf soils are fine-loamy. Lowell soils have bedrock at a depth of more than 40 inches. Wellston soils are fine-silty. They also have bedrock at a depth of more than 40 inches.

Typical pedon of Faywood silty clay loam, in a wooded area of Lowell-Faywood complex, 20 to 40 percent slopes, very stony; 16 miles north of Smithland, 0.8 mile east of the Ohio River, 0.8 mile south of the Kentucky Highway 137 bridge crossing McGilligan Creek; on soil map sheet 6, east-west about 1,211,200 and north-south about 373,900 feet by the Kentucky coordinate grid system:

A—0 to 5 inches; very dark grayish brown (10YR 3/2) silty clay loam; weak fine subangular blocky structure parting to weak fine granular; firm; common fine and medium roots; about 10 percent limestone rock fragments; medium acid; gradual wavy boundary.

Bt1—5 to 10 inches; dark yellowish brown (10YR 4/4) channery silty clay; moderate medium subangular blocky structure; very firm; common fine and medium roots; common distinct clay films on faces of peds; about 20 percent limestone channers; mildly alkaline; gradual wavy boundary.

Bt2—10 to 20 inches; yellowish brown (10YR 5/6) flaggy clay; moderate medium subangular blocky structure; very firm; few fine and medium roots; common distinct clay films on faces of peds; about 30 percent flagstones; mildly alkaline; gradual wavy boundary.

BC—20 to 36 inches; light olive brown (2.5Y 5/4) and yellowish brown (10YR 5/6) very flaggy clay; common coarse distinct light brownish gray (2.5Y 6/2) mottles; weak fine angular blocky structure; very firm; very sticky and plastic; few fine roots; about 35 percent flagstones; mildly alkaline.

R—36 inches; limestone bedrock.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The content of limestone rock fragments ranges from 0 to 35 percent throughout the solum. Reaction ranges from strongly acid to mildly alkaline throughout the solum.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 or 3. The Bt horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6, and chroma of 4 to 8. It is silty clay, clay, or the channery or very flaggy analogs of these textures. The BC horizon has matrix colors similar to those of the Bt horizon and is mottled in shades of brown, yellow, or gray. It is silty clay, clay, or the flaggy or very flaggy analogs of these textures.

Frondorf Series

The Frondorf series consists of moderately deep, well drained, moderately permeable soils on upland side slopes. These soils formed in a mantle of loess or silty colluvium over material weathered from sandstone, siltstone, or shale. Slopes range from 12 to 50 percent. The soils are fine-loamy, mixed, mesic Ultic Hapludalfs.

Frondorf soils are associated on the landscape with Faywood, Loring, Lowell, Wellston, and Zanesville soils. Faywood and Lowell soils are fine textured. Loring and Zanesville soils have a fragipan and have bedrock at a depth of more than 40 inches. Wellston soils are fine-silty and have bedrock at a depth of more than 40 inches.

Typical pedon of Frondorf silt loam, in a wooded area of Wellston-Frondorf silt loams, very rocky, 20 to 50 percent slopes; 4.4 miles due northwest of Lola, 1.1 miles northeast of the junction of Beam Road with Kentucky Highway 133, about 100 feet north of Sadler Creek; on soil map sheet 4, east-west about 1,241,000 feet and north-south about 386,250 feet by the Kentucky coordinate grid system:

A—0 to 2 inches; dark brown (10YR 3/3) silt loam; weak fine granular structure; friable; common fine and medium roots; strongly acid; clear smooth boundary.

EB—2 to 8 inches; yellowish brown (10YR 5/4) gravelly silt loam; common medium distinct brown (10YR 4/3) mottles; weak fine subangular blocky structure; friable; common fine and medium roots; about 15 percent sandstone fragments; very strongly acid; gradual wavy boundary.

Bt1—8 to 13 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; firm; common fine and medium roots; few distinct clay films on faces of peds; about 10 percent sandstone fragments; very strongly acid; clear smooth boundary.

Bt2—13 to 18 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; common fine and medium roots; common distinct clay films on faces of peds; about 5 percent sandstone fragments; very strongly acid; gradual wavy boundary.

2Bt3—18 to 25 inches; strong brown (7.5YR 5/6) gravelly silt loam; moderate medium subangular blocky structure; firm; common medium roots; common distinct clay films on faces of peds; about 20 percent sandstone fragments; strongly acid; gradual wavy boundary.

2Bt4—25 to 37 inches; strong brown (7.5YR 5/6) very channery silty clay loam; moderate medium subangular blocky structure; firm; common medium roots; common distinct clay films on faces of peds; about 40 percent sandstone channers; strongly acid; abrupt smooth boundary.

R—37 inches; sandstone bedrock, weathered in the upper part.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The content of rock fragments ranges from 0 to 15 percent to a depth of 12 to 24 inches and from 20 to 75 percent below these depths. In areas that have not been limed, reaction is very strongly acid or strongly acid throughout the solum.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The EB horizon has hue of 10YR, value of 5 or 6, and chroma of 4 to 6. It is silt loam or gravelly silt loam. The Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. It is silt loam, silty clay loam, or the gravelly or channery analogs of these textures. The 2Bt horizon has colors similar to those of the Bt horizon. It is silt loam, silty clay loam, sandy clay loam, or loam in the fine-earth fraction.

Hammack Series

The Hammack series consists of very deep, well drained, moderately permeable soils that formed in a mantle of loess and in the underlying material weathered from cherty limestone. These soils are on upland ridgetops and side slopes. Slopes range from 6 to 20 percent. The soils are fine-silty, mixed, mesic Glossic Paleudalfs.

Hammack soils are associated on the landscape with Baxter and Nicholson soils. Baxter soils are fine textured. Nicholson soils have a fragipan.

Typical pedon of Hammack silt loam, 6 to 12 percent slopes; about 1 mile north of Pinckneyville, 1 mile east of Kentucky Highway 723, at the intersection of McClure Road and Binkley Road; on soil map sheet 18, east-west about 1,276,300 feet and north-south about 324,950 feet by the Kentucky coordinate grid system:

Ap—0 to 7 inches; yellowish brown (10YR 5/4) silt loam; weak very fine granular structure; very friable; few fine roots; very strongly acid; abrupt smooth boundary.

Bt1—7 to 22 inches; brown (7.5YR 4/4) silty clay loam; moderate very fine and fine subangular blocky structure; friable; few fine roots; common distinct clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—22 to 28 inches; brown (7.5YR 4/4) silty clay loam; light brownish gray (10YR 6/2) silt coatings; moderate fine subangular blocky structure; firm; few fine roots; common distinct clay films on faces of peds; few black stains; very strongly acid; clear smooth boundary.

2B/E—28 to 40 inches; brown (7.5YR 5/4) extremely gravelly silty clay loam; light brownish gray (10YR 6/2) silt coatings on some peds and coarse fragments; moderate medium subangular blocky structure; firm; few fine roots; common distinct clay films on faces of peds and on coarse fragments; about 80 percent chert fragments; strongly acid; clear smooth boundary.

2Bt1—40 to 54 inches; yellowish red (5YR 5/6) clay; common fine faint reddish brown (2.5YR 4/4) and common fine prominent brownish yellow (10YR 6/8) mottles; strong fine angular blocky structure; very firm; few fine roots; common distinct clay films on faces of peds and on coarse fragments; about 5 percent chert fragments; medium acid; clear smooth boundary.

2Bt2—54 to 64 inches; reddish brown (2.5YR 4/4) gravelly clay; few fine prominent light brownish gray (10YR 6/2) and common medium prominent brownish yellow (10YR 6/6) mottles; strong fine and medium angular blocky structure; very firm; few fine roots; common distinct clay films on faces of peds; about 15 percent chert fragments; medium acid; clear smooth boundary.

2Bt3—64 to 76 inches; reddish brown (2.5YR 4/4) very gravelly clay; many medium prominent light brownish gray (10YR 6/2) and brownish yellow (10YR 6/6) mottles; strong fine angular blocky structure; very firm; few fine roots; few black stains; common distinct clay films on faces of peds; about 45 percent chert fragments; medium acid.

The depth to bedrock and the thickness of the solum are more than 6 feet. In areas that have not been limed, reaction ranges from very strongly acid to medium acid throughout the profile. The content of chert ranges from 0 to 5 percent in the upper part of the solum, from 35 to 80 percent in the 2B/E horizon, and from 0 to 75 percent in the 2Bt horizon.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. The Bt horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay loam or silt loam. The 2B/E horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 or 5, and chroma of 4 to 6. It is mottled in shades of brown and gray. It is the very gravelly or extremely gravelly analogs of silty clay loam or silt loam. The E part makes up 5 to 15 percent of the 2B/E horizon. It consists of silt coatings that have hue of 10YR or 7.5YR, value of 6 or 7, and chroma of 1 to 4. The 2Bt horizon has hue of 2.5YR or 5YR, value of 3 to 5, and chroma of 4 to 6. It is mottled in shades of gray, yellow, or brown. It is clay, silty clay, or silty clay loam in the fine-earth fraction.

Henshaw Series

The Henshaw series consists of very deep, somewhat poorly drained, moderately slowly permeable soils on stream terraces. These soils formed in mixed alluvium. Slopes range from 0 to 2 percent. The soils are fine-silty, mixed, mesic Aquic Hapludalfs.

Henshaw soils are associated on the landscape with McGary, Otwell, and Peoga soils. McGary soils are fine textured. Otwell soils are moderately well drained. Peoga soils are poorly drained.

Typical pedon of Henshaw silt loam, rarely flooded; about 1 mile east of Tiline, 300 yards east of the junction of a farm lane and Kentucky Highway 170, about 100 feet north of Kentucky Highway 170; on soil map sheet 18, east-west about 1,278,100 feet and north-south about 314,450 feet by the Kentucky coordinate grid system:

Ap—0 to 6 inches; brown (10YR 5/3) silt loam; weak fine granular structure; very friable; common fine roots; neutral; clear smooth boundary.

Bt1—6 to 15 inches; light olive brown (2.5Y 5/4) silt loam; common fine prominent yellowish brown (10YR 5/6) and common medium distinct light brownish gray (2.5Y 6/2) mottles; moderate medium subangular blocky structure; friable; few fine roots; few distinct clay films on faces of peds; strongly acid; clear wavy boundary.

Bt2—15 to 21 inches; light yellowish brown (2.5Y 6/4) silty clay loam; common fine prominent yellowish brown (10YR 5/6) and common medium distinct light brownish gray (2.5Y 6/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; common distinct clay films on faces of peds; few fine brown concretions; strongly acid; clear wavy boundary.

Btg1—21 to 36 inches; light brownish gray (2.5Y 6/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) and common medium prominent olive gray (5Y 5/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; common distinct clay films on faces of peds; strongly acid; clear wavy boundary.

Btg2—36 to 63 inches; light brownish gray (2.5Y 6/2) silty clay loam; many medium distinct olive gray (5Y 5/2) mottles; moderate medium subangular blocky structure; firm; few distinct clay films on faces of peds; medium acid.

The thickness of the solum ranges from 40 to 65 inches. The depth to bedrock is more than 5 feet. Reaction ranges from strongly acid to neutral in the Ap horizon, from strongly acid to slightly acid in the upper part of the subsoil, and from medium acid to moderately alkaline in the lower part of the subsoil.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 to 6. It is mottled in shades of gray or brown. It is silt loam or silty clay loam. The Btg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is mottled in shades of gray or brown. It is silt loam or silty clay loam.

Huntington Series

The Huntington series consists of very deep, well drained, moderately permeable soils on flood plains. These soils formed in mixed alluvium. Slopes range from 0 to 15 percent. The soils are fine-silty, mixed, mesic Fluventic Hapludolls.

Huntington soils are associated on the landscape with Lindside, Nelse, and Nolin soils. Lindside soils are moderately well drained. Nelse soils are coarse-loamy. Nolin soils do not have a mollic epipedon.

Typical pedon of Huntington silt loam, frequently flooded; about 12.6 miles north of Smithland, 0.6 mile east of the Ohio River, 0.7 mile west of Kentucky Highway 137; on soil map sheet 5, east-west about 1,202,200 feet and north-south about 363,900 feet by the Kentucky coordinate grid system:

Ap—0 to 13 inches; dark brown (10YR 3/3) silt loam; weak fine granular structure; very friable; few fine roots; mildly alkaline; clear smooth boundary.

Bw1—13 to 19 inches; dark grayish brown (10YR 4/2) silt loam; dark brown (10YR 3/3) ped faces; weak fine subangular blocky structure; friable; few fine roots; mildly alkaline; gradual smooth boundary.

Bw2—19 to 70 inches; brown (10YR 4/3) silt loam; dark yellowish brown (10YR 3/4) ped faces; moderate medium subangular blocky structure; firm; very few fine roots; common wormholes and wormcasts; mildly alkaline; gradual smooth boundary.

C—70 to 84 inches; brown (10YR 4/3), stratified silt loam, loam, and fine sand; massive; friable; neutral.

The thickness of the solum ranges from 40 to 70 inches. The depth to bedrock is more than 5 feet. Reaction ranges from medium acid to mildly alkaline throughout the profile.

The Ap horizon has hue of 10YR, value of 3, and chroma of 2 or 3. The Bw horizon has hue of 10YR, value of 4, and chroma of 2 to 4. It is silt loam or silty clay loam. The C horizon has colors similar to those of the Bw horizon. It is stratified silt loam, fine sandy loam, fine sand, loam, or silty clay loam.

Karnak Series

The Karnak series consists of very deep, poorly drained and very poorly drained soils that formed in slack-water alluvium on flood plains. Permeability is very slow or slow. Slopes range from 0 to 2 percent. The soils are fine, montmorillonitic, nonacid, mesic Vertic Haplaquepts.

The Karnak soils in this survey area are taxadjuncts to the series because they have mixed mineralogy.

Karnak soils are associated on the landscape with Lindside, Newark, and Nolin soils on flood plains and are commonly adjacent to Licking and McGary soils on nearby stream terraces. Lindside, Newark, and Nolin soils are fine-silty. Lindside soils are moderately well drained, Newark soils are somewhat poorly drained, and Nolin soils are well drained. Licking and McGary soils have an argillic horizon.

Typical pedon of Karnak silty clay, frequently flooded; about 1.5 miles north of Smithland, 0.5 mile east of the Ohio River, 0.4 mile west of U.S. Highway 60; on soil map sheet 19, east-west about 1,226,000 feet and north-south about 311,700 feet by the Kentucky coordinate grid system:

Ap—0 to 4 inches; brown (10YR 4/3) silty clay; weak fine granular structure; firm; few fine roots; neutral; gradual wavy boundary.

Bw1—4 to 10 inches; dark grayish brown (10YR 4/2) clay; weak medium angular blocky structure; very firm; few fine roots; dark grayish brown (2.5Y 4/2) pressure faces; neutral; gradual wavy boundary.

Bw2—10 to 15 inches; dark grayish brown (10YR 4/2) clay; few fine prominent yellowish brown (10YR 5/6) and few medium distinct grayish brown (2.5Y 5/2) mottles; weak medium and coarse angular blocky structure; very firm; few fine roots; dark grayish brown (2.5Y 4/2) pressure faces; neutral; clear smooth boundary.

Bg—15 to 32 inches; gray (5Y 5/1) clay; common fine prominent strong brown (7.5YR 5/6) and common medium faint grayish brown (2.5Y 5/2) mottles; weak medium angular blocky structure; very firm; few fine roots; neutral; gradual smooth boundary.

BCg—32 to 44 inches; grayish brown (2.5Y 5/2) clay; common medium prominent strong brown (7.5YR 5/8) and common medium faint light olive brown (2.5Y 5/4) mottles; weak fine angular blocky structure; very firm; strong brown (7.5YR 5/6) coatings along old root channels; slightly acid; gradual smooth boundary.

Cg1—44 to 56 inches; grayish brown (2.5Y 5/2) clay; many medium distinct strong brown (7.5YR 5/6) and common fine distinct light olive brown (2.5Y 5/4) mottles; massive; very firm; medium acid; gradual smooth boundary.

Cg2—56 to 62 inches; gray (5Y 5/1) clay; many medium distinct yellowish brown (10YR 5/6) mottles; massive; very firm; medium acid.

The thickness of the solum ranges from 30 to 60 inches. The depth to bedrock is more than 5 feet. Reaction ranges from medium acid to neutral throughout the profile.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 3. The Bw horizon has hue of 10YR, value of 4, and chroma of 2. It is mottled in shades of gray and brown. It is silty clay or clay. The Bg horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 7, and chroma of 1 or 2. It has higher chroma mottles than is typical; in some pedons the mottles have hue of 7.5YR. This horizon is silty clay or clay. The Cg horizon has colors and textures similar to those of the Bg horizon.

Licking Series

The Licking series consists of very deep, moderately well drained soils on stream terraces. Permeability is moderately slow in the upper part of the profile and slow in the lower part. These soils formed in clayey lacustrine deposits with a thin mantle of silty material. Slopes range from 2 to 12 percent. The soils are fine, mixed, mesic Aquic Hapludalfs.

Licking soils are associated on the landscape with Elk, Henshaw, McGary, and Otwell soils and are commonly associated with Lindside, Newark, and Nolin soils on nearby flood plains. Elk, Henshaw, Lindside, Newark, and Nolin soils are fine-silty. Elk soils are well drained. McGary soils are somewhat poorly drained. Otwell soils have a fragipan. Lindside, Newark, and Nolin soils do not have an argillic horizon.

Typical pedon of Licking silt loam, 2 to 6 percent slopes; about 12 miles north of Smithland, 1.5 miles east of Kentucky Highway 137, about 667 yards south of Bayou Creek, 250 feet north of Chipps School Road; on soil map sheet 10, east-west about 1,210,450 feet and north-south about 356,650 feet by the Kentucky coordinate grid system:

Ap—0 to 6 inches; brown (10YR 4/3) silt loam; weak fine granular structure; friable; few fine roots; medium acid; abrupt smooth boundary.

Bt1—6 to 12 inches; strong brown (7.5YR 5/8) silty clay loam; common medium distinct pale brown (10YR 6/3) and few medium faint strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; firm; common fine roots; few distinct brown (7.5YR 5/4) clay films on faces of peds; very strongly acid; clear smooth boundary.

2Bt2—12 to 19 inches; strong brown (7.5YR 5/6) silty clay; few medium distinct pale brown (10YR 6/3) and light brownish gray (2.5Y 6/2) mottles; moderate medium subangular blocky structure; very firm; few fine roots; few distinct brown (7.5YR 5/4) clay films on faces of peds; few fine black stains; strongly acid; clear smooth boundary.

2Bt3—19 to 32 inches; strong brown (7.5YR 5/6) silty clay; few medium distinct light brownish gray (2.5Y 6/2) and light yellowish brown (10YR 6/4) and few fine faint yellowish red mottles; moderate medium subangular blocky structure; very firm; few fine roots; common distinct brown (7.5YR 5/4) clay films on faces of peds; few medium black stains; strongly acid; clear smooth boundary.

2Bt4—32 to 60 inches; yellowish brown (10YR 5/6) silty clay; common medium distinct grayish brown (2.5Y 5/2), strong brown (7.5YR 5/8), and pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; very firm; few fine roots; common distinct brown (7.5YR 5/4) clay films on faces of peds; few medium black stains; neutral; clear smooth boundary.

2C—60 to 75 inches; yellowish brown (10YR 5/4) silt loam; common coarse distinct light brownish gray (10YR 6/2), gray (10YR 6/1), and yellowish red (7.5YR 4/6) mottles; massive; firm; 10 percent carbonate accumulations as much as 1 inch in diameter; few fine black stains; moderately alkaline.

The thickness of the solum ranges from 36 to 70 inches. The depth to bedrock is more than 5 feet. Reaction ranges from very strongly acid to medium acid in the Ap and Bt horizons, from strongly acid to neutral in the 2Bt horizon, and from medium acid to moderately alkaline in the 2C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is silt loam or silty clay loam. The Bt horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 or 5, and chroma of 4 to 8. It is mottled in shades of gray or brown. It is silt loam or silty clay loam. The 2Bt horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 or 5, and chroma of 4 to 6. It is mottled in shades of gray or brown. It is silty clay or clay. The 2C horizon has hue of 7.5YR, 10YR, 2.5YR, or 5Y, value of 3 to 5, and chroma of 3 to 6. It is mottled in shades of gray or brown. It is silt loam, silty clay loam, silty clay, or clay.

Lindside Series

The Lindside series consists of very deep, moderately well drained, moderately permeable soils on flood plains and in upland drainageways and depressions. These soils formed in mixed alluvium. Slopes range from 0 to 2 percent. The soils are fine-silty, mixed, mesic Fluvaquentic Eutrochrepts.

Lindside soils are associated on the landscape with Huntington, Newark, and Nolin soils. Huntington and Nolin soils are well drained. Huntington soils have a mollic epipedon. Newark soils are somewhat poorly drained.

Typical pedon of Lindside silt loam, frequently flooded; 1.3 miles northeast of the intersection of Kentucky Highway 137 and Birdsville Road at Birdsville, 250 feet north of Phelps Creek; on soil map sheet 13, east-west about 1,220,000 feet and north-south about 337,200 feet by the Kentucky coordinate grid system:

Ap—0 to 5 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; few fine roots; neutral; clear smooth boundary.

BA—5 to 12 inches; dark yellowish brown (10YR 4/4) silt loam; few fine faint pale brown and strong brown mottles; weak medium subangular blocky structure parting to weak fine granular; friable; few fine roots; few fine black stains; neutral; clear smooth boundary.

Bw1—12 to 26 inches; brown (10YR 4/3) silt loam; common medium distinct pale brown (10YR 6/3) and strong brown (7.5YR 5/6) mottles in the upper part; common medium distinct light brownish gray (10YR 6/2) mottles in the lower 7 inches; weak medium subangular blocky structure; friable; few fine roots; few fine black stains; slightly acid; clear smooth boundary.

Bw2—26 to 34 inches; brown (10YR 5/3) silt loam; common medium faint grayish brown (10YR 5/2) and few fine faint yellowish brown and brown mottles; moderate medium subangular blocky structure; friable; few fine roots; few fine black stains; slightly acid; clear smooth boundary.

Cg1—34 to 65 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct strong brown (7.5YR 5/6) and pale brown (10YR 6/3) mottles; massive; firm; few fine roots; few fine black stains; mildly alkaline; gradual smooth boundary.

Cg2—65 to 85 inches; gray (10YR 5/1) silty clay loam; stratified with loam and silt loam; common coarse prominent strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) mottles; massive; firm; few fine black stains and concretions; few carbonates in the lower 2 inches; mildly alkaline.

The thickness of the solum ranges from 25 to 50 inches. The depth to bedrock is more than 60 inches. Reaction ranges from strongly acid to mildly alkaline in the upper part of the subsoil and from medium acid to mildly alkaline in the lower part and in the substratum.

The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 2 or 3. The BA and Bw horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. They are mottled in shades of gray or brown. They are silt loam or silty clay loam. The Cg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is silt loam or silty clay loam or is stratified with silt loam, silty clay loam, or loam.

Loring Series

The Loring series consists of very deep, moderately well drained soils that formed in loess on upland ridgetops and side slopes. These soils have a fragipan. Permeability is moderate above the fragipan and moderately slow in the fragipan. Slopes range from 2 to 20 percent. The soils are fine-silty, mixed, thermic Typic Fragiudalfs.

Loring soils are associated on the landscape with Frondorf, Memphis, and Zanesville soils. Frondorf soils have bedrock at a depth of 20 to 40 inches and are fine-loamy. Memphis soils are well drained. Zanesville soils formed in loess and in material weathered from sandstone and shale.

Typical pedon of Loring silt loam, 2 to 6 percent slopes; about 6.0 miles north of Burna, 0.8 mile due north of the intersection of Sanderland Road and Kentucky Highway 838, about 200 feet west of Sanderland Road; on soil map sheet 7, east-west about 1,243,500 feet and north-south about 367,800 feet by the Kentucky coordinate grid system:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; few fine roots; mildly alkaline; clear smooth boundary.

Bt1—9 to 19 inches; strong brown (7.5YR 5/6) silt loam; weak fine subangular blocky structure; firm; few fine roots; few distinct clay films on faces of peds; strongly acid; gradual smooth boundary.

Bt2—19 to 26 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; firm; few fine roots; few distinct clay films on faces of peds; very strongly acid; clear wavy boundary.

Btx1—26 to 40 inches; strong brown (7.5YR 5/6) silt loam; common medium distinct light brownish gray (10YR 6/2) and common fine distinct brownish yellow (10YR 6/8) and pale brown (10YR 6/3) mottles; moderate very coarse prismatic structure; very firm, brittle, and compact; few fine roots between prisms; common distinct clay films on faces of peds; very strongly acid; gradual smooth boundary.

Btx2—40 to 55 inches; brown (7.5YR 4/4) silt loam; many coarse distinct light brownish gray (10YR 6/2) and common fine distinct pale brown (10YR 6/3) mottles; moderate very coarse prismatic structure; very firm, brittle, and compact; few fine roots between prisms; common distinct clay films on faces of peds; common light gray (10YR 7/1) silt coatings between prisms; very strongly acid; clear smooth boundary.

C—55 to 65 inches; strong brown (7.5YR 4/6) silt loam; few fine faint pale brown mottles; massive; firm; few fine roots; strongly acid.

The thickness of the solum ranges from 45 to 75 inches. The thickness of the loess is more than 48 inches. The depth to bedrock is more than 5 feet. In areas that have not been limed, reaction ranges from very strongly acid to medium acid throughout the profile.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. In some pedons it has low-chroma mottles in the lower part. This horizon is silt loam or silty clay loam. The Btx horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is mottled in shades of gray, yellow, or brown. It is silt loam or silty clay loam. The C horizon has colors similar to those of the Btx horizon. It is silt loam.

Lowell Series

The Lowell series consists of deep and very deep, well drained, moderately slowly permeable soils that formed in limestone residuum interbedded with shale. These soils are on upland side slopes. Slopes range from 12 to 40 percent. The soils are fine, mixed, mesic Typic Hapludalfs.

Lowell soils are associated on the landscape with Faywood, Frondorf, and Wellston soils. Faywood soils have bedrock at a depth of 20 to 40 inches. Frondorf soils are fine-loamy and have sandstone bedrock at a depth of 20 to 40 inches. Wellston soils are fine-silty.

Typical pedon of Lowell silt loam, in a wooded area of Lowell-Faywood complex, 20 to 40 percent slopes, very stony; 16.0 miles north of Smithland, 0.8 mile east of the Ohio River, 0.8 mile south of the Kentucky Highway 137 bridge crossing McGilligan Creek; on soil map sheet 6, east-west about 1,211,300 feet and north-south about 373,900 feet by the Kentucky coordinate grid system:

A—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; friable; common fine and medium roots; very strongly acid; gradual wavy boundary.

Bt1—4 to 9 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct brown (10YR 4/3) mottles; moderate medium subangular blocky structure; firm; common fine and medium roots; few distinct clay films on faces of peds; strongly acid; gradual wavy boundary.

Bt2—9 to 23 inches; strong brown (7.5YR 5/6) silty clay; few fine distinct pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; firm; common fine and medium roots; few distinct clay films on faces of peds; strongly acid; gradual wavy boundary.

Bt3—23 to 31 inches; strong brown (7.5YR 5/6) clay; moderate medium subangular blocky structure; very firm; few fine roots; common distinct clay films on faces of peds; common coarse black concretions; medium acid; clear smooth boundary.

Bt4—31 to 38 inches; yellowish brown (10YR 5/6) clay; weak fine angular blocky structure; very firm; few fine roots; few distinct clay films on faces of peds; common black stains; mildly alkaline; clear smooth boundary.

C—38 to 44 inches; light brownish gray (2.5Y 6/2) and weak red (2.5YR 4/2) clay; massive; very firm; few fine roots; about 10 percent weathered shale fragments; few black stains; mildly alkaline; abrupt smooth boundary.

R—44 inches; limestone bedrock.

The thickness of the solum ranges from 30 to 60 inches. The depth to bedrock ranges from 40 to more than 80 inches. The content of rock fragments ranges from 0 to 5 percent in the upper part of the solum, from 0 to 15 percent in the lower part of the solum, and from 1 to 15 percent in the substratum. Reaction ranges from very strongly acid to slightly acid above a depth of 30 inches and from strongly acid to mildly alkaline below this depth.

The A horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. In some pedons it has olive or gray mottles in the lower part. It is silty clay loam, silty clay, or clay. The C horizon has matrix colors and mottles in shades of brown, olive, or gray. It is silty clay or clay.

McGary Series

The McGary series consists of very deep, somewhat poorly drained, slowly permeable soils on stream terraces. These soils formed in clayey alluvium. Slopes range from 0 to 2 percent. The soils are fine, mixed, mesic Aeric Ochraqualfs.

The McGary soils in this survey area are taxadjuncts to the series because they are more brown in the upper part of the subsoil than is defined as the range for the series and because they display characteristics of Aquic Hapludalfs. These differences, however, do not affect use and management of the soils.

McGary soils are associated on the landscape with Henshaw, Licking, and Otwell soils. Licking soils are moderately well drained. Henshaw soils are fine-silty. Otwell soils have a fragipan.

Typical pedon of McGary silt loam, rarely flooded; about 5.8 miles north of Lola, 5.0 miles north of the junction of Lola-Slocum Road and Kentucky Highway 333, about 533 yards east of the junction of a farm road and Lola-Slocum Road, 200 feet north of the farm road; on soil map sheet 4, east-west about 1,255,500 feet and north-south about 390,000 feet by the Kentucky coordinate grid system:

Ap—0 to 7 inches; brown (10YR 5/3) silt loam; moderate fine granular structure; friable; common fine and few medium roots; few brown and black concretions; slightly acid; abrupt smooth boundary.

Bt1—7 to 13 inches; yellowish brown (10YR 5/4) silty clay; few fine faint yellowish brown and common fine distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; few fine and medium roots; few distinct clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—13 to 25 inches; yellowish brown (10YR 5/4) silty clay; common medium distinct grayish brown (10YR 5/2) mottles; moderate coarse subangular blocky structure; very firm; few fine and medium roots; few distinct clay films on faces of peds; medium acid; clear smooth boundary.

Bt3—25 to 37 inches; yellowish brown (10YR 5/6) silty clay; common medium distinct grayish brown (10YR 5/2) and brown (10YR 5/3) mottles; weak medium subangular blocky structure; very firm; few fine roots; few distinct clay films on faces of peds; common black organic stains; medium acid; clear smooth boundary.

CB—37 to 57 inches; yellowish brown (10YR 5/6) silty clay; grayish brown (10YR 5/2), brown (10YR 5/3), and greenish gray (5GY 5/1) streaks that are 3 inches wide; weak coarse prismatic structure parting to weak medium subangular blocky; very firm; few distinct pressure faces; slight effervescence; about 1 percent carbonates; neutral; clear smooth boundary.

Ck—57 to 72 inches; brown (10YR 5/3) silty clay; many medium distinct strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2) mottles; massive; very firm; few fine roots; thick common continuous pressure faces; about 7 percent carbonates; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 40 inches. The depth to bedrock is more than 5 feet. Reaction is slightly acid or neutral in the Ap horizon and ranges from medium acid to mildly alkaline in the Bt horizon. It is moderately alkaline in the C horizon.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or 3. Some pedons have a BE horizon, which has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. This horizon is silt loam or silty clay loam. The Bt horizon has hue of 10YR or 2.5Y and value and chroma of 4 to 6. It is mottled in shades of gray or brown. It is silty clay loam or silty clay. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 to 4. It is mottled in shades of gray, olive, or brown. It is silty clay or clay.

Melvin Series

The Melvin series consists of very deep, poorly drained, moderately permeable soils on flood plains. These soils formed in mixed alluvium. Slopes range from 0 to 2 percent. The soils are fine-silty, mixed, nonacid, mesic Typic Fluvaquents.

Melvin soils are associated on the landscape with Lindside, Newark, and Nolin soils. Lindside soils are moderately well drained. Newark soils are somewhat poorly drained. Nolin soils are well drained.

Typical pedon of Melvin silt loam, frequently flooded; 1.1 miles due southwest of Iuka, 0.4 mile south of the intersection of a gravel road and Corinth Road, 300 feet east of the gravel road; on soil map sheet 28, east-west about 1,271,900 feet and north-south about 277,100 feet by the Kentucky coordinate grid system:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; common medium distinct yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) mottles; weak fine granular structure; very friable; common fine and medium roots; mildly alkaline; clear smooth boundary.

Bg1—9 to 20 inches; light brownish gray (10YR 6/2) silt loam; common fine distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; firm; common fine and medium roots; medium acid; gradual wavy boundary.

Bg2—20 to 30 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct yellowish brown (10YR 5/6) and pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; firm; few fine and medium roots; medium acid; gradual wavy boundary.

Cg—30 to 62 inches; light brownish gray (10YR 6/2) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; few irregularly shaped manganese and iron concretions; medium acid.

The thickness of the solum ranges from 20 to 40 inches. The depth to bedrock is more than 5 feet. Reaction ranges from medium acid to mildly alkaline throughout the profile.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 3. It is mottled in shades of yellow, brown, or gray. The Bg horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2. It is mottled in shades of brown or yellow. It is silt loam or silty clay loam. The Cg horizon has colors and textures similar to those of the Bg horizon. In some pedons it is stratified with loam, sand, or clay.

Memphis Series

The Memphis series consists of very deep, well drained, moderately permeable soils on upland ridgetops and side slopes. These soils formed in loess. Slopes range from 2 to 30 percent. The soils are fine-silty, mixed, thermic Typic Hapludalfs.

The Memphis soils in this survey area are taxadjuncts to the series because they have hue of 5YR in the subsoil and substratum, have less than 60 percent base saturation 1.8 meters below the surface or 1.25 meters below the top of the argillic horizon, and display characteristics of Ultic Hapludalfs. These differences, however, do not affect use and management of the soils.

Memphis soils are associated on the landscape with Frondorf, Loring, Nicholson, and Zanesville soils. Frondorf soils have bedrock at a depth of 20 to 40 inches and are fine-loamy. Loring, Nicholson, and Zanesville soils have a fragipan.

Typical pedon of Memphis silt loam, 6 to 12 percent slopes; about 5.8 miles north of Lola, 5.0 miles north of the junction of Lola-Slocum Road and Kentucky Highway 333, about 400 yards east of the junction of a farm road and Lola-Slocum Road, 150 feet north of the farm road; on soil map sheet 4, east-west about 1,254,700 feet and north-south about 389,950 feet by the Kentucky coordinate grid system:

Ap—0 to 7 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine granular structure; very friable; common fine and medium roots; slightly acid; clear wavy boundary.

BA—7 to 12 inches; strong brown (7.5YR 5/6) and brown (10YR 4/3) silt loam; moderate fine and medium subangular blocky structure; friable; common fine and medium roots; streaks of light brown (7.5YR 6/4) along root channels; few distinct strong brown (7.5YR 4/6) clay films on faces of peds; slightly acid; clear smooth boundary.

Bt1—12 to 20 inches; strong brown (7.5YR 5/6) silt loam; moderate fine and medium subangular blocky structure; firm; common fine roots; streaks of brown (10YR 4/3) along root channels; common distinct strong brown (7.5YR 4/6) clay films on faces of peds; strongly acid; clear wavy boundary.

Bt2—20 to 30 inches; strong brown (7.5YR 5/6) silt loam; few fine distinct light yellowish brown (10YR 6/4) mottles; moderate medium subangular blocky structure; firm; common fine roots; common distinct brown (7.5YR 4/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt3—30 to 44 inches; strong brown (7.5YR 4/6) silt loam; few fine distinct pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; firm; few fine roots; few fine black stains along root channels; few distinct brown (7.5YR 4/4) clay films on faces of peds; strongly acid; gradual wavy boundary.

Bt4—44 to 60 inches; strong brown (7.5YR 4/6) silt loam; few fine faint strong brown (7.5YR 5/8) and few fine distinct pale brown (10YR 6/3) mottles; moderate coarse subangular blocky structure; firm; few fine roots; few fine black stains along root channels; few distinct brown (7.5YR 4/4) clay films on faces of peds; strongly acid; gradual wavy boundary.

BC—60 to 69 inches; brown (7.5YR 4/4) silt loam; few fine distinct pink (7.5YR 7/4) and brown (7.5YR 5.4) streaks; weak coarse subangular blocky structure; firm; few fine roots; few fine faint black stains on faces of peds; few faint clay films on faces of peds; strongly acid; gradual wavy boundary.

C1—69 to 78 inches; brown (7.5YR 4/4) silt loam; few fine distinct pink (7.5YR 7/4) streaks; massive; firm; few fine roots; few fine black stains along root channels; strongly acid; gradual wavy boundary.

C2—78 to 88 inches; brown (7.5YR 4/4) silt loam; massive; firm; strongly acid.

The thickness of the solum ranges from 32 to 70 inches. The depth to bedrock is more than 5 feet. In areas that have not been limed, reaction ranges from very strongly acid to medium acid throughout the profile.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The BA and Bt horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. They are silt loam or silty clay loam. The BC horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam. The C horizon has the same colors and textures as the BC horizon.

Nelse Series

The Nelse series consists of very deep, well drained soils on flood plains. These soils formed in sandy alluvium. Permeability is moderately rapid or rapid. Slopes range from 0 to 25 percent. The soils are coarse-loamy, mixed, nonacid, mesic Mollic Udifluvents.

Nelse soils are associated on the landscape with Huntington and Nolin soils. Huntington and Nolin soils are fine-silty.

Typical pedon of Nelse loam, frequently flooded; about 1.0 mile north of Bayou, 0.6 mile west of Kentucky Highway 137, about 500 feet east of the Ohio River; on soil map sheet 5, east-west about 1,203,000 feet and north-south about 366,900 feet by the Kentucky coordinate grid system:

Ap—0 to 10 inches; dark brown (10YR 3/3) loam; weak fine granular structure; very friable; common fine and medium roots; common wormcasts; moderately alkaline; clear smooth boundary.

A—10 to 18 inches; dark brown (10YR 3/3) loam; stratified with yellowish brown (10YR 5/6) fine sand; weak fine granular structure; friable; few fine roots; common wormcasts; moderately alkaline; abrupt smooth boundary.

C1—18 to 26 inches; dark brown (10YR 3/3) fine sandy loam; stratified with yellowish brown (10YR 5/6) fine sand; massive; very friable; few fine roots; common wormcasts; moderately alkaline; abrupt smooth boundary.

C2—26 to 36 inches; light yellowish brown (10YR 6/4) loamy fine sand; massive; common wormcasts; common black streaks ⅛ inch wide in the lower part; common very fine black concretions; moderately alkaline; abrupt smooth boundary.

C3—36 to 60 inches; yellowish brown (10YR 5/6) and pale brown (10YR 6/3), stratified silt loam and loamy fine sand; massive; moderately alkaline.

The soil is 60 or more inches thick. Reaction ranges from slightly acid to moderately alkaline throughout the profile.

The Ap and A horizons have hue of 10YR, value of 3, and chroma of 2 to 4. The C horizon has hue of 10YR, value of 3 to 6, and chroma of 2 to 6. It is fine sandy loam, loam, or loamy fine sand. In most pedons it has thin strata of silt loam, fine sand, or loamy very fine sand.

Newark Series

The Newark series consists of very deep, somewhat poorly drained, moderately permeable soils on flood plains. These soils formed in mixed alluvium. Slopes range from 0 to 2 percent. The soils are fine-silty, mixed, nonacid, mesic Aeric Fluvaquents.

Newark soils are associated on the landscape with Lindside, Melvin, and Nolin soils. Lindside soils are moderately well drained. Melvin soils are poorly drained. Nolin soils are well drained.

Typical pedon of Newark silt loam, frequently flooded; 1.8 miles northeast of Kentucky Highway 137 at Birdsville, 350 feet south of North Branch; on soil map sheet 13, east-west about 1,221,000 feet and north-south about 339,800 feet by the Kentucky coordinate grid system:

Ap—0 to 7 inches; brown (10YR 5/3) silt loam; few fine faint pale brown mottles; weak fine granular structure; friable; few fine roots; common brown stains; slightly acid; abrupt smooth boundary.

Bw—7 to 17 inches; yellowish brown (10YR 5/4) silt loam; many medium distinct light brownish gray (10YR 6/2) and strong brown (7.5YR 5/8) mottles and few fine faint pale brown mottles; weak fine subangular blocky structure parting to weak fine granular; friable; few fine roots; few black and brown concretions; medium acid; gradual smooth boundary.

Bg—17 to 37 inches; light brownish gray (10YR 6/2) silty clay loam; many fine and medium distinct strong brown (7.5YR 5/8) and yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; few fine roots; common black and brown concretions; neutral; gradual smooth boundary.

C1—37 to 49 inches; grayish brown (10YR 5/2) silt loam; few fine and medium distinct strong brown (7.5YR 5/6) mottles; massive; firm; few fine roots; mildly alkaline; clear smooth boundary.

C2—49 to 60 inches; grayish brown (10YR 5/2) silty clay; many coarse prominent strong brown (7.5YR 5/8) mottles; massive; firm; very few fine roots; common black and brown concretions; mildly alkaline.

The thickness of the solum ranges from 22 to 44 inches. The depth to bedrock is more than 5 feet. Reaction ranges from medium acid to mildly alkaline throughout the profile.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The Bw horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is mottled in shades of brown or gray. It is silt loam or silty clay loam. The Bg horizon has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 1 or 2. It is mottled in shades of brown or gray. It is silt loam or silty clay loam. Some pedons have a Cg horizon, which has matrix colors and textures similar to those of the Bg horizon. This horizon is mottled in shades of brown or gray. The C horizon has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 2 to 4. It has mottles that are neutral in color or are shades of brown or gray. This horizon is silt loam, silty clay loam, or silty clay.

Nicholson Series

The Nicholson series consists of very deep, moderately well drained soils that formed in loess over cherty material weathered from limestone on upland ridgetops and side slopes. These soils have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. Slopes range from 6 to 20 percent. The soils are fine-silty, mixed, mesic Typic Fragiudalfs.

Nicholson soils are associated on the landscape with Baxter, Hammack, and Memphis soils. Baxter, Hammack, and Memphis soils do not have a fragipan.

Typical pedon of Nicholson silt loam, 6 to 12 percent slopes, severely eroded; about 2.7 miles north of Lola, 1.2 miles north of Kentucky Highway 133, about 300 feet east of the junction of Lola-Slocum Road and Ellis School Road, 100 feet north of Lola-Slocum Road; on soil map sheet 4, east-west about 1,253,700 feet and north-south about 378,950 feet by the Kentucky coordinate grid system:

Ap—0 to 6 inches; yellowish brown (10YR 5/4) silt loam; few fine faint strong brown mottles; weak fine granular structure; friable; few fine roots, neutral; clear smooth boundary.

Bt—6 to 13 inches; yellowish brown (10YR 5/6) silt loam; few fine faint strong brown and pale brown mottles; weak medium subangular structure parting to moderate fine subangular blocky; friable; few fine roots; few prominent brown (7.5YR 4/4) clay films on faces of peds; strongly acid; clear smooth boundary.

Btx—13 to 28 inches; yellowish brown (10YR 5/6) silt loam; common medium distinct light brownish gray (10YR 6/2), light gray (10YR 7/1), and strong brown (7.5YR 4/6) mottles; moderate very coarse prismatic structure; very firm, compact, and brittle; few distinct clay films in pores and on vertical faces of peds; strongly acid; clear smooth boundary.

2Bt1—28 to 43 inches; red (2.5YR 4/6) silty clay loam; common medium distinct pale brown (10YR 6/3), few fine distinct yellowish brown (10YR 5/8), and few medium distinct brown (7.5YR 5/4) mottles; moderate medium subangular blocky structure; firm; few distinct clay films on faces of peds; few fine black stains; strongly acid; clear smooth boundary.

2Bt2—43 to 56 inches; red (2.5YR 4/6) silty clay loam; few fine distinct light gray (10YR 7/1 and 7/2) and common medium distinct yellowish brown (7.5YR 5/4) mottles; moderate medium subangular blocky and moderate medium platy structure; firm; few distinct clay films on faces of peds; common fine black stains; medium acid; clear smooth boundary.

2C—56 to 68 inches; red (2.5YR 4/6) silty clay; few fine faint red and few fine prominent light gray (10YR 7/2) and yellowish brown (10YR 5/4) mottles; massive; very firm; common fine black stains; slightly acid.

The thickness of the solum ranges from 40 to 80 inches. The depth to bedrock is more than 5 feet. In areas that have not been limed, reaction ranges from very strongly acid to slightly acid in and above the fragipan and from strongly acid to mildly alkaline below the fragipan. The content of limestone, shale, or siltstone fragments ranges from 0 to 15 percent in the 2Bt horizon and from 0 to 30 percent in the 2C horizon.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam or silty clay loam. The Btx horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 4 to 8. It is mottled in shades of brown or gray. It is silt loam or silty clay loam. The 2Bt horizon has hue of 2.5YR to 2.5Y, value of 4 or 5, and chroma of 4 to 6. It is mottled in shades of brown or gray. It is silty clay loam, silty clay, clay, or the gravelly analogs of these textures. The 2C horizon has matrix colors and mottles similar to those of the 2Bt horizon. It is silty clay, clay, or the gravelly analogs of these textures.

Nolin Series

The Nolin series consists of very deep, well drained, moderately permeable soils on flood plains. These soils formed in mixed alluvium. Slopes range from 0 to 2 percent. The soils are fine-silty, mixed, mesic Dystric Fluventic Eutrochrepts.

Nolin soils are associated on the landscape with Huntington, Lindside, and Nelse soils. Huntington soils have a mollic epipedon. Lindside soils are moderately well drained. Nelse soils are coarse-loamy.

Typical pedon of Nolin silt loam, frequently flooded; about 6.5 miles due southeast of Smithland, 500 feet west of Haddock Road, 200 feet north of the Tennessee River; on soil map sheet 27, east-west about 1,239,700 feet and north-south about 276,400 feet by the Kentucky coordinate grid system:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam; weak fine granular structure; friable; few fine roots; few mica flakes; medium acid; gradual smooth boundary.

Bw1—9 to 22 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure; friable; few fine roots; few mica flakes; slightly acid; gradual smooth boundary.

Bw2—22 to 40 inches; brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; few fine roots; few mica flakes; medium acid; clear smooth boundary.

C—40 to 72 inches; yellowish brown (10YR 5/4) silty clay loam; few fine faint pale brown and strong brown mottles; massive; firm; few fine black concretions; strongly acid.

The thickness of the solum ranges from 40 to 60 inches. The depth to bedrock is more than 5 feet. Reaction ranges from medium acid to moderately alkaline in the solum and from strongly acid to moderately alkaline in the C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The Bw horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or silty clay loam. It has colors and textures similar to those of the Bw horizon. It is mottled in shades of brown or gray.

Otwell Series

The Otwell series consists of very deep, moderately well drained soils that formed in 20 to 40 inches of loess over mixed alluvium on stream terraces. These soils have a fragipan. Permeability is moderately slow above the fragipan and very slow in the fragipan. Slopes range from 2 to 12 percent. The soils are fine-silty, mixed, mesic Typic Fragiudalfs.

Otwell soils are associated on the landscape with Elk, Henshaw, Peoga, and Wheeling soils. Elk, Henshaw, and Peoga soils do not have a fragipan. Elk soils are well drained, Henshaw soils are somewhat poorly drained, and Peoga soils are poorly drained. Wheeling soils are fine-loamy and are well drained.

Typical pedon of Otwell silt loam, 2 to 6 percent slopes; 6.1 miles northeast of Smithland, 1.0 mile northwest of Scotts Chapel, 0.3 mile north of Miller Lane, 0.4 mile east of the Cumberland River; on soil map sheet 17, east-west about 1,236,100 feet and north-south about 321,900 feet by the Kentucky coordinate grid system:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; weak fine granular structure; friable; few fine roots; slightly acid; abrupt smooth boundary.

Bt1—8 to 13 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure parting to weak fine granular; friable; few fine roots; few faint strong brown (7.5YR 5/6) clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—13 to 22 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; common distinct brown (7.5YR 4/4) clay films on faces of peds and in pores; very strongly acid; clear smooth boundary.

Bt3—22 to 28 inches; strong brown (7.5YR 5/6) silty clay loam; few medium faint light yellowish brown (10YR 6/4) mottles; moderate medium subangular blocky structure; firm; very few fine roots; common faint brown (7.5YR 5/4) clay films on faces of peds; few fine black and brown concretions; very strongly acid; clear smooth boundary.

2Btx1—28 to 35 inches; yellowish brown (10YR 5/6) silt loam; few fine distinct light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) mottles; moderate very coarse prismatic structure parting to moderate medium subangular blocky; very firm, brittle, and compact; common distinct light yellowish brown (10YR 6/4) clay films on faces of peds; very strongly acid; clear smooth boundary.

2Btx2—35 to 51 inches; brown (7.5YR 4/4) silty clay loam; common medium distinct light brownish gray (10YR 6/2) and pale brown (10YR 6/3) mottles; moderate very coarse prismatic structure parting to moderate medium subangular blocky; very firm, brittle, and compact; few distinct light yellowish brown (10YR 6/4) clay films on faces of peds; very strongly acid; clear smooth boundary.

2C—51 to 67 inches; brown (7.5YR 4/2) silt loam; common medium distinct light yellowish brown (10YR 6/4) and light brownish gray (10YR 6/2) mottles; massive; common black and brown stains; strongly acid.

The thickness of the solum ranges from 40 to 70 inches. The depth to bedrock is more than 5 feet. Reaction ranges from very strongly acid to neutral in the Ap horizon, is very strongly acid or strongly acid in the Bt and 2Btx horizons, and is moderately alkaline below the fragipan.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is mottled in shades of brown, and in the lower part it is mottled in shades of gray. It is silt loam or silty clay loam. The 2Btx horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 7, and chroma of 2 to 6. It is mottled in shades of gray and brown. It is silty clay loam or silt loam. The 2C horizon has colors and textures similar to those of the Btx horizon.

Peoga Series

The Peoga series consists of very deep, poorly drained, slowly permeable soils on stream terraces. These soils formed in silty sediments of mixed origin. Slopes range from 0 to 2 percent. The soils are fine-silty, mixed, mesic Typic Ochraqualfs.

Peoga soils are associated on the landscape with Henshaw and Otwell soils. Henshaw soils are somewhat poorly drained. Otwell soils are moderately well drained and have a fragipan.

Typical pedon of Peoga silt loam; 467 yards southwest of the east intersection of Rudd-Spees Road and U.S. Highway 60 in Ledbetter; on soil map sheet 25, east-west about 1,205,500 feet and north-south about 270,000 feet by the Kentucky coordinate grid system:

Ap—0 to 6 inches; grayish brown (2.5Y 5/2) silt loam; common fine prominent yellowish brown (10YR 5/6) mottles; weak fine and medium granular structure; friable; many fine roots; strongly acid; clear smooth boundary.

Btg1—6 to 16 inches; light brownish gray (2.5Y 6/2) silt loam; common fine and medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; many fine roots; few distinct clay films on faces of peds; medium acid; clear smooth boundary.

Btg2—16 to 24 inches; grayish brown (2.5Y 5/2) silt loam; many medium prominent yellowish brown (10YR 5/6) mottles; common streaks of light gray (2.5Y 7/2) silt coatings; moderate medium subangular blocky structure; firm; common fine roots; few distinct clay films on faces of peds; strongly acid; clear wavy boundary.

Btxg—24 to 38 inches; light olive gray (5Y 6/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) and few fine prominent strong brown (7.5YR 5/8) mottles; few streaks of light gray (2.5Y 7/2) silt coatings; strong medium subangular blocky structure; very firm; common fine roots; common distinct clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt—38 to 56 inches; light olive brown (2.5Y 5/4) silty clay loam; common medium prominent strong brown (7.5YR 5/8) and common medium distinct gray (N 6/0) mottles; common light gray (2.5Y 7/2) silt coatings; moderate medium subangular blocky structure; very firm; few fine roots; common distinct clay films on faces of peds; very strongly acid; gradual wavy boundary.

2BC—56 to 62 inches; yellowish brown (10YR 5/4) loam; common fine distinct yellowish brown (10YR 5/8) and light brownish gray (2.5Y 6/2) mottles; weak fine subangular blocky structure; firm; few fine roots; slightly acid.

The thickness of the solum ranges from 40 to more than 80 inches. The depth to bedrock is more than 5 feet. Reaction ranges from strongly acid to neutral in the Ap horizon, from very strongly acid to medium acid in the Bt horizon, and from very strongly acid to slightly acid in the 2BC horizon.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 1 to 3. The Btg, Btxg, and Bt horizons have hue of 10YR, 2.5Y, or 5Y, value of 4 to 7, and chroma of 1 to 6. They are mottled in shades of brown or gray. They are silt loam or silty clay loam. The 2BC horizon has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 1 to 6. It is mottled in shades of gray or brown. It is loam, silt loam, clay loam, or silty clay loam.

Saffell Series

The Saffell series consists of very deep, well drained, moderately permeable soils on upland side slopes. These soils formed in loamy and gravelly Coastal Plain material. Slopes range from 20 to 40 percent. The soils are loamy-skeletal, siliceous, thermic Typic Hapludults.

Saffell soils are associated on the landscape with Baxter, Brandon, Hammack, and Loring soils. Baxter soils are fine textured and formed in material weathered from cherty limestone. Brandon and Hammack soils are fine-silty. Loring soils have a fragipan.

Typical pedon of Saffell gravelly silt loam, 20 to 40 percent slopes; about 2 miles north of the intersection of Kentucky Highway 453 and U.S. Highways 62 and 641 at Lake City, 200 yards southeast of Corinth Church; on soil map sheet 28, east-west about 1,268,300 feet and north-south about 269,600 feet by the Kentucky coordinate grid system:

Ap—0 to 8 inches; brown (10YR 4/3) gravelly silt loam; weak fine granular structure; friable; common fine and medium roots; about 25 percent pebbles less than 3 inches in diameter; slightly acid; clear smooth boundary.

BA—8 to 15 inches; yellowish brown (10YR 5/4) very gravelly silt loam; weak fine subangular blocky structure; friable; common fine and medium roots; about 45 percent pebbles less than 3 inches in diameter; slightly acid; clear wavy boundary.

Bt1—15 to 30 inches; strong brown (7.5YR 5/6) extremely gravelly clay loam; moderate medium subangular blocky structure; firm; few fine roots; about 65 percent pebbles less than 3 inches in diameter; few distinct clay films on faces of peds; very strongly acid; gradual wavy boundary.

Bt2—30 to 44 inches; strong brown (7.5YR 5/6) extremely gravelly sandy clay loam; moderate fine subangular blocky structure; firm; about 65 percent pebbles less than 3 inches in diameter and 5 percent pebbles 3 to 5 inches in diameter; few distinct clay films on faces of peds; very strongly acid; gradual wavy boundary.

BC—44 to 54 inches; yellowish red (5YR 5/6) extremely gravelly sandy clay loam; few fine distinct pale brown (10YR 6/3) and yellowish red (5YR 4/8) mottles; weak fine subangular blocky structure; firm; about 60 percent pebbles less than 3 inches in diameter and 10 percent pebbles 3 to 5 inches in diameter; very strongly acid; clear wavy boundary.

C—54 to 72 inches; yellowish red (5YR 5/8) extremely gravelly sandy loam; massive; firm; about 75 percent quartz pebbles less than 3 inches in diameter; very strongly acid.

The thickness of the solum ranges from 35 to 60 inches. The depth to bedrock is more than 5 feet. In areas that have not been limed, reaction is very strongly acid or strongly acid throughout the profile. The content of rock fragments, dominantly pebble sized, ranges from 15 to 35 percent in the surface layer, from 35 to 65 percent in the subsoil, and from 20 to 75 percent in the substratum.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 6. The BA horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 or 5, and chroma of 4 to 6. It is the very gravelly or extremely gravelly analogs of silt loam, sandy clay loam, or loam. The Bt horizon has hue of 7.5YR, 5YR, or 2.5YR, value of 4 to 6, and chroma of 4 to 8. It is the very gravelly or extremely gravelly analogs of sandy clay loam, loam, fine sandy loam, or clay loam. The BC horizon has colors similar to those of the Bt horizon. It is mottled in shades of red, brown, or yellow. It is the very gravelly or extremely gravelly analogs of loam, sandy loam, loamy sand, or sandy clay loam. The C horizon has colors similar to those of the Bt horizon. It is the gravelly, very gravelly, or extremely gravelly analogs of sandy loam, loamy sand, or sandy clay loam.

Wellston Series

The Wellston series consists of deep and very deep, well drained, moderately permeable soils on upland side slopes. These soils formed in a mantle of loess over material weathered from sandstone or siltstone. Slopes range from 20 to 50 percent. The soils are fine-silty, mixed, mesic Ultic Hapludalfs.

Wellston soils are associated on the landscape with Faywood, Frondorf, Loring, Lowell, and Zanesville soils. Faywood and Lowell soils are fine textured. Frondorf soils are fine-loamy and have bedrock at a depth of 20 to 40 inches. Loring and Zanesville soils have a fragipan.

Typical pedon of Wellston silt loam, in a wooded area of Wellston-Frondorf silt loams, very rocky, 20 to 50 percent slopes; about 2.8 miles due east of Burna, about 0.9 mile due south of U.S. Highway 60, about 33 yards northwest of lookout tower on Lockhart Bluff; on soil map sheet 15, east-west about 1,258,400 feet and north-south about 339,950 feet by the Kentucky coordinate grid system:

A—0 to 6 inches; brown (10YR 4/3) silt loam; weak fine granular structure; friable; common medium roots; about 10 percent sandstone fragments; slightly acid; gradual smooth boundary.

BA—6 to 9 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; few medium roots; about 10 percent sandstone fragments; medium acid; gradual smooth boundary.

Bt1—9 to 26 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium and coarse subangular blocky structure; firm; few fine roots; common distinct brown (7.5YR 4/4) clay films on faces of peds; medium acid; gradual smooth boundary.

Bt2—26 to 35 inches; strong brown (7.5YR 5/8) silty clay loam; few fine prominent light yellowish brown (10YR 6/4) mottles; moderate medium subangular structure; very firm; few fine roots; common prominent brown (7.5YR 4/4) clay films on faces of peds; medium acid; gradual smooth boundary.

2BC—35 to 45 inches; brown (7.5YR 4/4) silt loam; common medium distinct brown (10YR 5/3) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; very firm; few fine roots; few prominent light gray (10YR 7/2) silt coatings on faces of peds; about 10 percent sandstone fragments; strongly acid; abrupt smooth boundary.

R—45 inches; sandstone bedrock.

The thickness of the solum ranges from 32 to 55 inches. The depth to bedrock ranges from 40 to 72 inches. The content of rock fragments, mainly sandstone and siltstone, ranges from 0 to 15 percent in the A and BA horizons and in the upper part of the Bt horizon, from 0 to 60 percent in the 2Bt and 2BC horizons, and from 0 to 90 percent in the 2C horizon. In areas that have not been limed, reaction ranges from very strongly acid to medium acid throughout the solum.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 to 3. The BA horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 8. It is silt loam or gravelly silt loam. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 8. It is silt loam, silty clay loam, or the gravelly or channery analogs of these textures. The 2Bt horizon, if it occurs, has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam, silty clay loam, or the gravelly, very gravelly, channery, or very channery analogs of these textures. The 2BC horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 or 5, and chroma of 3 to 6. It is silt loam, silty clay loam, clay loam, or loam in the fine-earth fraction. Some pedons have a 2C horizon. This horizon has colors and textures similar to those of the 2BC horizon.

Wheeling Series

The Wheeling series consists of very deep, well drained, moderately permeable soils on stream terraces. These soils formed in mixed alluvium. Slopes range from 0 to 55 percent. The soils are fine-loamy, mixed, mesic Ultic Hapludalfs.

Wheeling soils are associated on the landscape with Chavies, Elk, Henshaw, and Otwell soils. Chavies soils are coarse-loamy. Elk, Henshaw, and Otwell soils are fine-silty.

Typical pedon of Wheeling silt loam, 2 to 6 percent slopes; about 0.6 mile northwest of the west intersection of Rudd-Spees Road and U.S. Highway 60 in Ledbetter, 333 yards south of the Ohio River; on soil map sheet 25, east-west about 1,194,450 feet and north-south about 273,350 feet by the Kentucky coordinate grid system:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; common fine roots; neutral; abrupt smooth boundary.

Bt1—9 to 16 inches; strong brown (7.5YR 5/6) silt loam; weak fine subangular blocky structure; friable; few fine roots; few prominent brown (7.5YR 4/4) clay films on faces of peds; few fine black concretions; few mica flakes; slightly acid; clear smooth boundary.

Bt2—16 to 35 inches; strong brown (7.5YR 5/6) loam; few fine faint brownish yellow mottles; moderate medium subangular blocky structure; firm; common fine roots; common prominent brown (7.5YR 4/4) clay films on faces of peds; few fine black and brown concretions; few fine mica flakes; strongly acid; clear smooth boundary.

Bt3—35 to 57 inches; strong brown (7.5YR 5/6) loam; few fine faint brownish yellow mottles; weak medium subangular blocky structure; firm; few fine roots; few prominent brown (7.5YR 4/4) clay films on faces of peds; few fine black concretions; few fine mica flakes; strongly acid; gradual smooth boundary.

CB—57 to 80 inches; strong brown (7.5YR 5/6) loam;

common medium distinct brownish yellow (10YR 6/6) and few fine distinct yellowish red (5YR 5/8) mottles; weak medium and coarse subangular blocky structure; firm; common fine black concretions; few fine mica flakes; strongly acid; gradual smooth boundary.

C—80 to 96 inches; strong brown (7.5YR 5/6) and brownish yellow (10YR 6/6), stratified loam and sandy loam; massive; common fine black concretions; few fine mica flakes; strongly acid.

The thickness of the solum ranges from 40 to 60 inches. The depth to bedrock is more than 5 feet. In areas that have not been limed, reaction ranges from strongly acid to medium acid throughout the profile.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam, silt loam, or silty clay loam. The CB and C horizons have colors similar to those of the Bt horizon. They are loam or sandy loam or are stratified with very fine sand or sand.

Zanesville Series

The Zanesville series consists of deep and very deep, well drained or moderately well drained soils that formed in loess over material weathered from sandstone and shale on upland side slopes. These soils have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. Slopes range from 6 to 20 percent. The soils are fine-silty, mixed, mesic Typic Fragiudalfs.

Zanesville soils are associated on the landscape with Frondorf and Loring soils. Frondorf soils have bedrock at a depth of 20 to 40 inches and are fine-loamy. Loring soils formed in loess more than 48 inches thick.

Typical pedon of Zanesville silt loam, 12 to 20 percent slopes, severely eroded; about 2.1 miles due northeast of Hampton, 0.5 mile due northeast of the intersection of Sanderland Road and Kentucky Highway 838, about 266 yards west of Sanderland Road; on soil map sheet 7, east-west about 1,236,650 feet and north-south about 366,100 feet by the Kentucky coordinate grid system:

Ap—0 to 5 inches; brown (10YR 4/3) silt loam; weak fine granular structure; friable; few fine roots; neutral; clear smooth boundary.

Bt1—5 to 10 inches; brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few fine roots; few distinct clay films on faces of peds; neutral; clear smooth boundary.

Bt2—10 to 18 inches; strong brown (7.5YR 5/6) silty clay loam; few fine faint brown and common medium distinct light yellowish brown (10YR 6/4) mottles; moderate medium subangular blocky structure; firm; few fine roots; common distinct clay films on faces of peds; very strongly acid; clear wavy boundary.

Btx—18 to 29 inches; brown (7.5YR 4/4) silt loam; common medium distinct light brownish gray (10YR 6/2) and light yellowish brown (10YR 6/4) mottles; moderate very coarse prismatic structure parting to weak medium subangular blocky; very firm, brittle, and compact; few fine roots along prism faces; few distinct clay films on faces of peds; very strongly acid; gradual smooth boundary.

2Bt—29 to 39 inches; strong brown (7.5YR 5/6) silt loam; few fine distinct light brownish gray (10YR 6/2) and light yellowish brown (10YR 6/4) mottles; weak fine and medium subangular blocky structure; firm; few distinct clay films on faces of peds; few black stains; about 5 percent sandstone fragments; very strongly acid; gradual smooth boundary.

2C1—39 to 59 inches; strong brown (7.5YR 5/6) silt loam; common medium distinct light yellowish brown (10YR 6/4) and few fine prominent light gray (10YR 7/2) and yellowish red (5YR 5/6) mottles; massive; firm; about 5 percent sandstone fragments; very strongly acid; gradual smooth boundary.

2C2—59 to 68 inches; brown (7.5YR 4/4) silt loam; few fine distinct strong brown (7.5YR 5/6) and light gray (10YR 7/2) mottles and common medium distinct light yellowish brown (10YR 6/4) mottles; massive; firm; about 5 percent sandstone fragments; medium acid.

The thickness of the solum ranges from 35 to 70 inches. The depth to bedrock ranges from 40 to 80 inches. The content of rock fragments in the 2Bt and 2C horizons ranges from 5 to 50 percent. In areas that have not been limed, reaction ranges from very strongly acid to medium acid throughout the profile.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. Some pedons have an A horizon, which has lower value and chroma than the Ap horizon. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The Btx horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is mottled in shades of gray. It is silt loam, silty clay loam, or sandy clay loam. The 2Bt and 2C horizons have colors similar to those of the Btx horizon. They are silt loam, silty clay loam, sandy clay loam, or the channery or very channery analogs of these textures.

Formation of the Soils

This section relates the factors of soil formation to the soils in the survey area and describes the processes of soil formation.

Factors of Soil Formation

Soil is a natural three-dimensional body that supports plants on the earth's surface. It has properties resulting from the interaction of climate and living matter with parent material and is conditioned by relief over time.

The interaction of the five main factors of soil formation results in differences among soils. These factors are the physical and chemical composition of the parent material; the climate during and after the accumulation of the parent material; the kinds of plants and animals living on and in the soil; relief, or lay of the land, and its effect on drainage; and the length of time the soil-forming factors have been in progress. In the following paragraphs the factors of soil formation are discussed as they relate to the soils in Livingston County.

Climate

Climate affects the physical, chemical, and biological relationships in soils. It influences the kind and number of plants and animals on and in the soils, the weathering and decomposition of rocks and minerals, the susceptibility of the soils to erosion, and the rate of soil formation.

The climate of Livingston County is humid and temperate. The average annual precipitation is 53 inches, and the mean annual air temperature is 59 degrees F. The soils are seldom completely dry and are frozen for short periods of time; therefore, the processes of soil formation have continued almost uninterrupted. This almost continual process has leached many of the soluble bases and clay minerals from upper to lower horizons within the soil and, in some instances, has leached them completely from the soil. As a result, many of the soils in the county have a leached, acid surface layer and a subsoil that is finer textured than the surface layer. Examples are Brandon, Memphis, and Zanesville soils.

Plant and Animal Life

Plants affect soil formation mainly by adding organic matter. Animals, bacteria, and fungi contribute to soil formation by converting the remains of plants to organic matter and plant nutrients. The organic matter imparts a dark color to the soil material, and the humus, or decomposed organic matter, aids in the formation of soil structure.

Animals, such as moles, mice, groundhogs, and crawfish, burrow through and mix the soils. Many forms of small animal life in or on the soil, such as earthworms, grubs, and insects, alter soil structure. Mixing of soil material by rodents has not been significant in Livingston County. Plants generally have had a greater influence than animals on the soils in the survey area.

The native vegetation of the county was mostly hardwood forests. Soils in the uplands, such as Zanesville and Frondorf soils, have characteristics that are typical of soils that formed under hardwood forests. These soils are acid and have a thin, dark surface layer and a subsoil that has more clay than either the surface layer or the substratum.

Humans have altered the soil by removing trees and mixing the surface layer into the plow layer. In a few places they have leveled or graded the soil or even mixed the soil with the underlying bedrock. They have added fertilizer and lime and introduced new plants. Humans also have accelerated erosion on uplands and increased deposition on the flood plains. Nevertheless, except for altering the surface layer, their influence on soil formation has been minor in most places.

Parent Material

Parent material is the unconsolidated mass in which soils form. It is a product of the weathering or decomposition of underlying bedrock or transported materials. Parent material influences the mineral and chemical composition of the soil and, to a large extent, the rate at which soil formation takes place. The kinds of parent material in Livingston County are loess, alluvium, and loess and residuum derived from bedrock.

Loess, which is wind-deposited silt, is on most of the uplands in the county. It ranges from a few inches to over 20 feet in thickness. Loring and Memphis soils formed in loess more than 4 feet thick.

Under the loess is interbedded sandstone, siltstone, shale, limestone, or gravelly and loamy Coastal Plain deposits. Most of the soils that formed where the loess is less than 4 feet thick formed partly in loess and partly in residuum derived from the underlying bedrock. Frondorf, Wellston, and Zanesville soils formed in loess and in the underlying residuum derived from sandstone and siltstone. Nicholson soils formed in loess and in the underlying residuum derived from limestone. Baxter, Faywood, Hammack, and Lowell soils formed in residuum derived from cherty limestone or limestone and have a clayey subsoil. Brandon soils formed in 20 to 40 inches of loess and in the underlying Coastal Plain deposits, and Saffell soils formed entirely in very gravelly deposits of Coastal Plain material.

Both recent and old alluvial deposits occur along streams throughout the survey area. The alluvium in the narrow valleys was washed from the nearby loess-covered uplands and has a high content of silt. Soils such as Nolin, Lindside, and Newark soils formed in this alluvium.

The Cumberland, Ohio, and Tennessee Rivers, which have large drainage areas, have deposited alluvium from a variety of parent materials. Ashton, Elk, Henshaw, Huntington, Otwell, and Wheeling soils formed in alluvium deposited by these rivers. The river valleys and tributaries also have soils that formed in alluvium deposited under slack-water conditions. These soils, which contain a high content of clay, include Dunning, Karnak, Licking, and McGary soils.

Relief

Relief influences soil formation through its effects on drainage, erosion, soil temperature, soil depth, and plant cover. In Livingston County, relief ranges from nearly level to very steep.

Nearly level soils range from well drained to poorly drained. Most gently sloping to moderately steep soils are moderately well drained or well drained, and most steep to very steep soils are well drained. Soils that are nearly level and that have excess water for long periods of time have gray colors in the subsoil that are characteristic of poorly drained or somewhat poorly drained soils. Henshaw, Karnak, McGary, Melvin, Newark, and Peoga soils are examples. Soils that have a subsoil that is mainly brown and that have a few gray mottles are moderately well drained. Lindside and Loring soils are examples. Soils that have a brown subsoil are well drained. Elk and Memphis soils are examples.

Soils that are nearly level to moderately steep may have a fragipan, which is a characteristic of some soils in which permeability is restricted. Soils that have a fragipan are on stream terraces or uplands. Loring, Nicholson, Otwell, and Zanesville soils are examples.

Relief also affects the thickness of the loess in the uplands. The loess is thicker on gently sloping soils than it is on the steeper soils. Loring and Memphis soils formed in thick loess deposits. Soils that are moderately steep to very steep formed either in loess and residuum or entirely in residuum. Wellston and Zanesville soils formed in loess and residuum, and Lowell and Faywood soils formed in residuum. Generally, soils on the steeper slopes are less deep and are less well developed than soils in gently sloping areas because of increased runoff, which restricts the rate of infiltration and the degree of leaching and soil development. Erosion on the steeper slopes removes material from the surface nearly as rapidly as the residuum is formed. Faywood and Frondorf soils are examples of soils on the steeper slopes.

The influences of soil temperature and plant cover on soil development are more pronounced on the steeper slopes than in gently sloping areas. Differences in soil development are most readily observed by comparing north-facing and south-facing slopes. South-facing slopes are slightly warmer than north-facing slopes, and they erode and weather at a faster rate. Plant cover also is different on north-facing and south-facing slopes. These differences in soil temperature and plant cover, however, have had only a minor effect on soil formation in Livingston County.

Time

A long period of time is required for the development of distinct soil profiles. The length of time required depends upon the nature of the parent material and the relief. With the exception of soils that formed in recent alluvium, enough time has elapsed for the factors of soil formation to be evident in the soils of Livingston County.

Soils that formed in recent alluvium have weak horizon development. The surface horizon may have only a slight increase in the content of organic matter, and the subsoil may have weak structure. Soils of this type, such as Huntington and Nolin soils, are said to be young or immature.

Distinct horizons develop in these soils after a long time if no additional sediments are deposited. The weathering process causes some of the fine material in the surface layer to move into the subsoil, thus altering the color and structure of the subsoil. Elk and Wheeling soils are examples of older soils that formed in alluvium.

A soil is generally said to be mature when it has been in place and subject to the influence of plants, animals, and climate long enough to acquire distinct profile characteristics. Soils that formed in residuum or loess on stable upland landscapes have a well developed soil profile. Memphis, Loring, and Zanesville soils are examples.

Processes of Soil Formation

The formation of a succession of soil layers, or horizons, is the result of one or more of the following processes: accumulation of organic matter; leaching of carbonates and other soluble minerals; chemical weathering (chiefly by hydrolysis) of primary minerals into silicate clay minerals; translocation of the silicate clays, and probably some silt-sized particles, from one horizon to another; and reduction and transfer of iron.

Several of these processes have been active in the formation of most of the soils in Livingston County. The interaction of the first four processes is reflected in the strongly expressed horizons of the Memphis soils. All five processes have probably been active in the formation of the moderately well drained Loring and Nicholson soils.

Some organic matter has accumulated in all of the soils in the county to form the surface layer, or A horizon. Most of the uneroded soils contain moderate amounts of organic matter in the surface layer.

Most of the soils in the county are acid in the upper layers, although they formed in nonacid materials. The carbonates and other soluble materials have been partially leached into the lower layers or have been leached out of the soil profile. Lowell and McGary soils are examples of soils in which this process has taken place.

The translocation of clay minerals is an important process in the horizon development of many of the soils in the county. As clay minerals are removed from the A horizon, they accumulate as clay films on ped surfaces and along pores and root channels in the B horizon. This process is evident in all of the soils on terraces and uplands.

A fragipan has formed in the B horizon of some of the moderately well drained soils on uplands and terraces. The fragipan is a dense, compact layer that is hard or very hard when dry, is brittle when moist, and tends to rupture suddenly rather than deform slowly when lateral pressure is applied. It generally is mottled, is slowly permeable or very slowly permeable, and has few to many bleached fracture planes that form polygons. The soils in the county that have a fragipan are Loring, Nicholson, Otwell, and Zanesville soils.

The reduction and transfer of iron has occurred in all soils that do not have good natural drainage. The reduction process is known as gleying, and gleyed soils are identified by gray colors and mottles. Part of the iron may be reoxidized and segregated under a fluctuating water table, which results in yellowish brown, strong brown, and other brightly colored mottles in an essentially gray matrix in the subsoil. Nodules or concretions of iron, manganese, or iron and manganese are commonly formed under these conditions. Examples of soils in which this process has occurred include Melvin and Peoga soils.

As silicate clay forms primary minerals, some iron is commonly freed as hydrated oxide. These oxides are more or less red. Even if present in small amounts, they give a brownish color to the soil material. They are largely responsible for the strong brown and yellowish brown colors that dominate the subsoil of many of the soils in the county.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazingland for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic)—Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated)—Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay are in the soil. The soil is not a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant that is not a grass or a sedge.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is, in part, a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as accumulation of clay, sesquioxides, humus, or a combination of these; prismatic or blocky structure; redder or browner colors than those in the A horizon; or a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the surface.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material. This contrasts with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments that are 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water to move through the profile. Permeability is measured as the number of inches per hour that water moves through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Subsurface tunnels or pipelike cavities are formed by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of the acidity or alkalinity of a soil expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Rippable bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). There is a shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the Earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, thickness of the line can be one fragment or more. It generally overlies material that weathered in place, and it is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in organic matter content than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed on the contour or at a slight angle to the contour across sloping soils. The terrace intercepts surface runoff, so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, such as zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced by atmospheric agents in rocks or other deposits at or near the earth's surface. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. This contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1967-87 at Gilbertsville Dam, Kentucky)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average daily	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	42.8	25.1	34.0	69	-4	20	3.44	1.49	5.09	6	5.1
February	48.8	29.1	39.0	74	3	27	3.37	1.77	4.76	6	4.4
March	60.3	38.9	49.6	83	17	130	4.97	2.79	6.88	9	1.3
April	71.9	48.6	60.3	89	29	314	5.25	2.61	7.53	8	.0
May	80.4	57.3	68.9	94	38	586	5.24	3.28	7.00	8	.0
June	88.5	65.7	77.1	99	49	813	3.84	2.45	5.08	6	.0
July	92.2	69.5	80.9	102	55	958	4.73	2.60	6.61	7	.0
August	90.5	67.7	79.1	102	54	902	5.09	2.25	7.51	6	.0
September	84.1	61.4	72.8	97	42	684	3.66	1.66	5.36	6	.0
October	72.7	49.9	61.3	87	29	357	3.15	1.51	4.55	5	.0
November	59.0	40.4	49.7	80	18	100	4.98	2.75	6.94	8	.1
December	48.6	31.2	39.9	69	6	36	5.15	1.67	7.98	8	.8
Yearly:											
Average	70.0	48.7	59.4	---	---	---	---	---	---	---	---
Extreme	---	---	---	103	-6	---	---	---	---	---	---
Total	---	---	---	---	---	4,927	52.87	44.33	60.69	83	11.7

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1967-87 at Gilbertsville Dam, Kentucky)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Mar. 24	Apr. 9	Apr. 16
2 years in 10 later than--	Mar. 18	Apr. 4	Apr. 11
5 years in 10 later than--	Mar. 7	Mar. 24	Apr. 1
First freezing temperature in fall:			
1 year in 10 earlier than--	Nov. 7	Oct. 28	Oct. 19
2 years in 10 earlier than--	Nov. 12	Nov. 2	Oct. 24
5 years in 10 earlier than--	Nov. 21	Nov. 11	Nov. 3

TABLE 3.--GROWING SEASON

(Recorded in the period 1967-87 at Gilbertsville Dam, Kentucky)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	235	210	198
8 years in 10	243	217	204
5 years in 10	258	231	215
2 years in 10	274	246	226
1 year in 10	282	253	232

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AsA	Ashton silt loam, 0 to 4 percent slopes, occasionally flooded	3,520	1.6
BaE	Baxter gravelly silt loam, 20 to 50 percent slopes	7,670	3.5
BrC	Brandon silt loam, 6 to 12 percent slopes	850	0.4
BrC3	Brandon silt loam, 6 to 12 percent slopes, severely eroded	460	0.2
BrD	Brandon silt loam, 12 to 20 percent slopes	4,540	2.1
BrD3	Brandon silt loam, 12 to 20 percent slopes, severely eroded	2,930	1.3
ChB	Chavies fine sandy loam, 2 to 6 percent slopes	260	0.1
ChD	Chavies fine sandy loam, 6 to 20 percent slopes	510	0.2
Du	Dunning silty clay, frequently flooded	670	0.3
EkA	Elk silt loam, 0 to 2 percent slopes	350	0.2
EkB	Elk silt loam, 2 to 6 percent slopes	1,830	0.8
EkC	Elk silt loam, 6 to 12 percent slopes	300	0.1
FrD	Frondorf silt loam, 12 to 20 percent slopes	4,290	2.0
FrD3	Frondorf silt loam, 12 to 20 percent slopes, severely eroded	550	0.2
FrE	Frondorf silt loam, 20 to 30 percent slopes	5,730	2.6
HaC	Hammack silt loam, 6 to 12 percent slopes	580	0.3
HaC3	Hammack silt loam, 6 to 12 percent slopes, severely eroded	350	0.2
HaD	Hammack silt loam, 12 to 20 percent slopes	3,680	1.7
HaD3	Hammack silt loam, 12 to 20 percent slopes, severely eroded	3,060	1.4
Hn	Henshaw silt loam, rarely flooded	4,740	2.2
Hu	Huntington silt loam, frequently flooded	3,470	1.6
Ka	Karnak silty clay, frequently flooded	1,120	0.5
LcB	Licking silt loam, 2 to 6 percent slopes	1,610	0.7
LkC3	Licking silty clay loam, 6 to 12 percent slopes, severely eroded	730	0.3
Ln	Lindside silt loam, frequently flooded	9,580	4.4
LoB	Loring silt loam, 2 to 6 percent slopes	20,480	9.3
LoC	Loring silt loam, 6 to 12 percent slopes	8,600	3.9
LoC3	Loring silt loam, 6 to 12 percent slopes, severely eroded	9,990	4.6
LoD	Loring silt loam, 12 to 20 percent slopes	1,560	0.7
LoD3	Loring silt loam, 12 to 20 percent slopes, severely eroded	1,880	0.9
LwD	Lowell-Faywood complex, 12 to 20 percent slopes, very stony	710	0.3
LwE	Lowell-Faywood complex, 20 to 40 percent slopes, very stony	5,020	2.3
Mc	McGary silt loam, rarely flooded	4,210	1.9
Me	Melvin silt loam, frequently flooded	820	0.4
MmB	Memphis silt loam, 2 to 6 percent slopes	1,810	0.8
MmC	Memphis silt loam, 6 to 12 percent slopes	1,030	0.5
MmC3	Memphis silt loam, 6 to 12 percent slopes, severely eroded	1,440	0.7
MmD	Memphis silt loam, 12 to 30 percent slopes	660	0.3
MmD3	Memphis silt loam, 12 to 30 percent slopes, severely eroded	870	0.4
Na	Nelse loam, frequently flooded	2,270	1.0
Nb	Nelse-Huntington complex, frequently flooded	312	0.1
NcE	Nelse-Huntington-Wheeling complex, 2 to 55 percent slopes, frequently flooded	1,430	0.7
Ne	Newark silt loam, frequently flooded	5,860	2.7
NhC	Nicholson silt loam, 6 to 12 percent slopes	360	0.2
NhC3	Nicholson silt loam, 6 to 12 percent slopes, severely eroded	1,200	0.5
NhD	Nicholson silt loam, 12 to 20 percent slopes	380	0.2
NhD3	Nicholson silt loam, 12 to 20 percent slopes, severely eroded	690	0.3
No	Nolin silt loam, frequently flooded	5,080	2.3
OtB	Otwell silt loam, 2 to 6 percent slopes	4,870	2.2
OtC3	Otwell silt loam, 6 to 12 percent slopes, severely eroded	850	0.4
Pe	Peoga silt loam	1,680	0.8
Pt	Pits, quarries	1,360	0.6
Pu	Pits-Udorthents complex	1,180	0.5
SaE	Saffell gravelly silt loam, 20 to 40 percent slopes	2,660	1.2
WfE	Wellston-Frondorf silt loams, very rocky, 20 to 50 percent slopes	13,360	6.1
WhA	Wheeling silt loam, 0 to 2 percent slopes	370	0.2
WhB	Wheeling silt loam, 2 to 6 percent slopes	1,490	0.7
WhC	Wheeling silt loam, 6 to 12 percent slopes	880	0.4
WhD	Wheeling silt loam, 12 to 20 percent slopes	320	0.1
ZaC	Zanesville silt loam, 6 to 12 percent slopes	1,480	0.7
ZaC3	Zanesville silt loam, 6 to 12 percent slopes, severely eroded	18,700	8.5

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
ZaD	Zanesville silt loam, 12 to 20 percent slopes	2,110	1.0
ZaD3	Zanesville silt loam, 12 to 20 percent slopes, severely eroded	8,020	3.7
	Water areas more than 40 acres in size	19,713	9.0
	Total	219,085	100.0

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Soybeans	Wheat	Grass-legume hay	Alfalfa hay	Pasture
		Bu	Bu	Bu	Ton	Ton	AUM*
AsA------------- Ashton	IIw	125	50	60	4.0	---	8.0
BaE------------- Baxter	VIIe	---	---	---	---	---	4.0
BrC------------- Brandon	IIIe	105	35	40	4.0	---	8.0
BrC3------------ Brandon	IVe	80	30	35	---	---	4.0
BrD------------- Brandon	IVe	---	---	---	4.0	---	8.0
BrD3------------ Brandon	VIe	---	---	---	---	---	3.5
ChB------------- Chavies	IIe	120	40	60	4.0	4.5	8.0
ChD------------- Chavies	IIIe	105	---	45	4.0	4.0	8.0
Du-------------- Dunning	IIIw	110	40	45	4.0	---	8.0
EkA------------- Elk	I	140	50	60	4.5	5.0	9.0
EkB------------- Elk	IIe	135	50	60	4.5	5.0	9.0
EkC------------- Elk	IIIe	120	40	60	4.0	4.5	8.0
FrD------------- Frondorf	IVe	---	---	---	2.5	---	5.0
FrD3------------ Frondorf	VIe	---	---	---	2.0	---	4.0
FrE------------- Frondorf	VIe	---	---	---	---	---	4.0
HaC------------- Hammack	IIIe	100	35	45	4.0	4.5	8.0
HaC3------------ Hammack	IVe	85	30	35	4.0	4.0	5.5
HaD------------- Hammack	IVe	85	20	30	4.0	4.0	8.0
HaD3------------ Hammack	VIe	---	---	---	3.0	3.5	5.5

See footnotes at end of table.

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Wheat	Grass-legume hay	Alfalfa hay	Pasture
		Bu	Bu	Bu	Ton	Ton	AUM*
Hn-------------- Henshaw	IIw	100	45	45	4.0	---	8.0
Hu-------------- Huntington	IIw	140	50	60	5.0	5.0	10.0
Ka-------------- Karnak	IIIw	100	40	40	4.0	---	8.0
LcB------------- Licking	IIe	100	35	50	4.0	3.5	8.0
LkC3------------ Licking	IVe	95	30	35	4.0	---	7.0
Ln-------------- Lindside	IIw	130	50	60	4.0	4.0	8.0
LoB------------- Loring	IIe	120	45	55	5.0	4.0	9.0
LoC------------- Loring	IIIe	105	35	50	4.0	3.0	8.0
LoC3------------ Loring	IVe	85	30	40	2.5	---	4.0
LoD------------- Loring	IVe	90	---	40	2.5	---	4.0
LoD3------------ Loring	VIe	---	---	---	2.5	---	4.0
LwD------------- Lowell-Faywood	VIs	---	---	---	2.5	---	4.0
LwE------------- Lowell-Faywood	VIe	---	---	---	---	---	3.5
Mc-------------- McGary	IIIw	100	40	---	4.0	---	8.0
Me-------------- Melvin	IIIw	100	40	40	4.0	---	8.0
MmB------------- Memphis	IIe	135	50	60	5.0	5.0	10.0
MmC------------- Memphis	IIIe	120	40	50	4.5	4.5	9.0
MmC3------------ Memphis	IVe	85	30	40	3.5	3.0	7.0
MmD------------- Memphis	VIe	---	---	---	---	---	7.0
MmD3------------ Memphis	VIIe	---	---	---	---	---	6.0

See footnotes at end of table.

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Wheat	Grass-legume hay	Alfalfa hay	Pasture
		Bu	Bu	Bu	Ton	Ton	AUM*
Na------------- Nelse	IIw	140	40	50	5.0	---	9.0
Nb------------- Nelse-Huntington	IIw	140	40	45	5.0	---	9.0
NcE------------ Nelse-Huntington-Wheeling	VIe	---	---	---	---	---	---
Ne------------- Newark	IIw	120	45	55	4.5	---	8.5
NhC------------ Nicholson	IIIe	110	40	50	4.0	3.0	8.0
NhC3----------- Nicholson	IVe	100	35	40	2.5	---	6.0
NhD------------ Nicholson	IVe	105	---	45	3.5	---	7.0
NhD3----------- Nicholson	VIe	---	---	---	2.5	---	4.0
No------------- Nolin	IIw	135	50	60	5.0	4.5	10.0
OtB------------ Otwell	IIe	110	40	50	4.0	4.0	8.0
OtC3----------- Otwell	IVe	85	30	35	2.5	---	6.0
Pe------------- Peoga	IIIw	100	40	45	4.0	---	8.0
Pt**----------- Pits, quarries	VIIIs	---	---	---	---	---	---
Pu**----------- Pits-Udorthents	VIIs	---	---	---	---	---	---
SaE------------ Saffell	VIIe	---	---	---	---	---	4.0
WfE------------ Wellston-Frondorf	VIIe	---	---	---	---	---	---
WhA------------ Wheeling	I	140	50	60	5.0	5.0	10.0
WhB------------ Wheeling	IIe	135	50	60	5.0	5.0	10.0

See footnotes at end of table.

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Wheat	Grass-legume hay	Alfalfa hay	Pasture
		Bu	Bu	Bu	Ton	Ton	AUM*
WhC------------- Wheeling	IIIe	120	40	50	4.0	5.0	8.0
WhD------------- Wheeling	IVe	105	---	45	3.5	4.0	7.0
ZaC------------- Zanesville	IIIe	100	35	45	3.5	3.0	8.0
ZaC3------------ Zanesville	IVe	85	30	40	3.0	---	7.0
ZaD------------- Zanesville	IVe	90	---	40	3.0	---	7.0
ZaD3------------ Zanesville	VIe	---	---	---	2.5	---	5.5

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

(Miscellaneous areas are excluded. Absence of an entry indicates no acreage)

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	720	---	---	---
II	67,182	32,350	34,832	---
III	23,090	14,590	8,500	---
IV	50,600	50,600	---	---
V	---	---	---	---
VI	30,680	29,970	---	710
VII	25,740	24,560	---	1,180
VIII	1,360	---	---	1,360

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
AsA------------- Ashton	Slight	Slight	Moderate	Severe	Sweetgum------------	87	98	Eastern white pine, yellow poplar, black walnut, sweetgum, cherrybark oak, eastern cottonwood, white ash.
					Pin oak-------------	94	91	
					Hackberry-----------	---	---	
					Hickory-------------	---	---	
					Shumard oak---------	93	89	
					Red maple-----------	---	---	
					White ash-----------	---	---	
					American sycamore---	---	---	
					American elm--------	---	---	
					Cherrybark oak------	---	---	
					White oak-----------	---	---	
BaE------------- Baxter	Severe	Severe	Slight	Severe	Black oak-----------	81	63	Yellow poplar, eastern white pine, shortleaf pine, white ash, white oak, northern red oak, loblolly pine.
					White oak-----------	74	56	
					Northern red oak----	---	---	
					Yellow poplar-------	92	93	
					Hickory-------------	---	---	
					Sassafras-----------	---	---	
					Sugar maple---------	---	---	
BrC, BrC3------- Brandon	Slight	Slight	Slight	Severe	Black oak-----------	72	54	Eastern white pine, loblolly pine, shortleaf pine, northern red oak, white oak.
					White oak-----------	61	44	
					Hickory-------------	---	---	
					Scarlet oak---------	69	51	
					Southern red oak----	71	53	
					Chestnut oak--------	---	---	
					Yellow poplar-------	80	71	
BrD------------- Brandon (warm aspect)	Moderate	Moderate	Moderate	Severe	Black oak-----------	63	46	Loblolly pine, shortleaf pine, Virginia pine, white oak.
					White oak-----------	---	---	
					Hickory-------------	---	---	
					Scarlet oak---------	60	43	
					Southern red oak----	61	44	
					Chestnut oak--------	---	---	
					Post oak------------	---	---	
BrD------------- Brandon (cool aspect)	Moderate	Moderate	Slight	Severe	Black oak-----------	72	54	Eastern white pine, loblolly pine, shortleaf pine, northern red oak, white oak.
					White oak-----------	61	44	
					Hickory-------------	---	---	
					Scarlet oak---------	69	51	
					Southern red oak----	71	53	
					Chestnut oak--------	---	---	
					Yellow poplar-------	80	71	
BrD3------------ Brandon (warm aspect)	Moderate	Moderate	Moderate	Moderate	Black oak-----------	50	34	Loblolly pine, shortleaf pine, Virginia pine, white oak.
					White oak-----------	---	---	
					Hickory-------------	---	---	
					Scarlet oak---------	---	---	
					Southern red oak----	---	---	
					Chestnut oak--------	---	---	
					Post oak------------	---	---	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
BrD3------------ Brandon (cool aspect)	Moderate	Moderate	Slight	Moderate	Black oak-----------	60	43	Eastern white pine, loblolly pine, shortleaf pine, white oak.
					White oak-----------	55	38	
					Hickory-------------	---	---	
					Scarlet oak---------	60	43	
					Southern red oak----	62	45	
					Chestnut oak--------	---	---	
ChB, ChD-------- Chavies	Slight	Slight	Slight	Severe	Shortleaf pine------	76	122	Eastern white pine, yellow poplar, black walnut, northern red oak, white oak, shortleaf pine, loblolly pine.
					Northern red oak----	---	---	
					Yellow poplar-------	93	95	
					Black walnut--------	---	---	
					Black cherry--------	---	---	
					Sugar maple---------	---	---	
					Red maple-----------	---	---	
					Hickory-------------	---	---	
					White oak-----------	---	---	
					American sycamore---	---	---	
Du-------------- Dunning	Slight	Moderate	Severe	Severe	Pin oak-------------	95	95	Pin oak, American sycamore, baldcypress, swamp white oak, sweetgum.
					Sweetgum------------	95	122	
					Eastern cottonwood--	100	128	
					Red maple-----------	---	---	
					American sycamore---	---	---	
					Boxelder------------	---	---	
					Black willow--------	---	---	
					Swamp white oak-----	---	---	
EkA, EkB, EkC--- Elk	Slight	Slight	Slight	Severe	Yellow poplar-------	91	92	Eastern white pine, yellow poplar, black walnut, loblolly pine, white oak, northern red oak, cherrybark oak, white ash, shortleaf pine.
					Cherrybark oak------	95	133	
					Pin oak-------------	96	93	
					Hackberry-----------	---	---	
					Red maple-----------	---	---	
					American sycamore---	---	---	
					Black walnut--------	---	---	
FrD, FrE-------- Frondorf (warm aspect)	Moderate	Moderate	Moderate	Moderate	White oak-----------	68	50	Loblolly pine, shortleaf pine, white oak.
					Post oak------------	73	55	
					Scarlet oak---------	---	---	
					Southern red oak----	---	---	
					Hickory-------------	---	---	
					Black oak-----------	70	52	
FrD, FrE-------- Frondorf (cool aspect)	Moderate	Moderate	Slight	Moderate	White oak-----------	74	56	Yellow poplar, shortleaf pine, white oak, eastern white pine, loblolly pine, northern red oak.
					Black oak-----------	78	60	
					Yellow poplar-------	---	---	
					Hickory-------------	---	---	
					Virginia pine-------	72	112	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Potential productivity: Common trees	Site index	Volume*	Trees to plant
FrD3------------ Frondorf (warm aspect)	Moderate	Moderate	Moderate	Moderate	White oak-----------	55	38	Loblolly pine, shortleaf pine.
					Post oak------------	---	---	
					Scarlet oak---------	---	---	
					Southern red oak----	---	---	
					Hickory-------------	---	---	
					Black oak-----------	70	52	
					Virginia pine-------	65	100	
FrD3------------ Frondorf (cool aspect)	Moderate	Moderate	Slight	Moderate	White oak-----------	65	47	Shortleaf pine, white oak, eastern white pine, loblolly pine.
					Black oak-----------	---	---	
					Yellow poplar-------	---	---	
					Hickory-------------	---	---	
					Virginia pine-------	70	109	
HaC------------- Hammack	Slight	Slight	Slight	Severe	Yellow poplar-------	88	86	Yellow poplar, northern red oak, shortleaf pine, loblolly pine, eastern white pine.
					Black oak-----------	80	62	
					Hickory-------------	---	---	
					Southern red oak----	80	62	
					Sugar maple---------	---	---	
HaC3------------ Hammack	Slight	Slight	Slight	Moderate	Southern red oak----	70	52	Eastern white pine, shortleaf pine, loblolly pine, white oak.
					Black oak-----------	70	52	
					Yellow poplar-------	80	71	
					Hickory-------------	---	---	
					Sugar maple---------	---	---	
HaD------------- Hammack	Moderate	Moderate	Slight	Severe	Yellow poplar-------	88	86	Yellow poplar, northern red oak, shortleaf pine, loblolly pine, eastern white pine.
					Black oak-----------	80	62	
					Hickory-------------	---	---	
					Southern red oak----	80	62	
					Sugar maple---------	---	---	
HaD3------------ Hammack	Moderate	Moderate	Slight	Moderate	Southern red oak----	70	52	Eastern white pine, shortleaf pine, loblolly pine, white oak.
					Black oak-----------	70	52	
					Yellow poplar-------	80	71	
					Hickory-------------	---	---	
					Sugar maple---------	---	---	
Hn-------------- Henshaw	Slight	Moderate	Slight	Severe	Pin oak-------------	95	92	Green ash, sweetgum, eastern cottonwood, eastern white pine, loblolly pine.
					Green ash-----------	---	---	
					Sweetgum------------	95	122	
					Hackberry-----------	---	---	
					American sycamore---	---	---	
					White oak-----------	---	---	
					Red maple-----------	---	---	
Hu-------------- Huntington	Slight	Slight	Slight	Severe	Yellow poplar-------	95	98	Yellow poplar, northern red oak, white ash, black walnut, eastern white pine, loblolly pine.
					Northern red oak----	---	---	
					White oak-----------	---	---	
					Black walnut--------	70	---	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Potential productivity: Common trees	Site index	Volume*	Trees to plant
Ka-------------- Karnak	Slight	Moderate	Severe	Severe	Pin oak-------------	96	93	Pin oak, swamp white oak, green ash, baldcypress, sweetgum.
					Swamp white oak-----	---	---	
					Eastern cottonwood--	---	---	
					Green ash-----------	---	---	
					Silver maple--------	---	---	
					Shumard oak---------	103	101	
LcB, LkC3------- Licking	Slight	Slight	Slight	Severe	White oak-----------	76	58	Eastern white pine, yellow poplar, white ash, white oak, northern red oak.
					Northern red oak----	80	62	
					Yellow poplar-------	90	90	
					Black cherry--------	---	---	
					Sugar maple---------	---	---	
					White ash-----------	---	---	
Ln-------------- Lindside	Slight	Slight	Moderate	Severe	Northern red oak----	86	68	Eastern white pine, yellow poplar, black walnut, northern red oak, white ash, white oak, loblolly pine.
					Yellow poplar-------	95	98	
					Black walnut--------	---	---	
					White ash-----------	85	---	
					White oak-----------	85	67	
					Red maple-----------	---	---	
LoB------------- Loring	Slight	Slight	Slight	Severe	Yellow poplar-------	88	86	Yellow poplar, white oak, northern red oak, loblolly pine, sweetgum, shortleaf pine, eastern white pine.
					Southern red oak----	62	45	
					Black oak-----------	67	49	
					Sweetgum------------	---	---	
					Loblolly pine-------	88	127	
					White oak-----------	70	52	
					Scarlet oak---------	70	52	
LoC, LoC3------- Loring	Slight	Slight	Slight	Severe	Yellow poplar-------	78	68	Loblolly pine, shortleaf pine.
					Southern red oak----	---	---	
					Black oak-----------	60	43	
					Loblolly pine-------	---	---	
					White oak-----------	60	43	
					Scarlet oak---------	60	43	
LoD------------- Loring	Moderate	Moderate	Slight	Severe	Yellow poplar-------	88	86	Yellow poplar, white oak, northern red oak, sweetgum, loblolly pine, shortleaf pine, eastern white pine.
					Southern red oak----	62	45	
					Black oak-----------	67	49	
					Sweetgum------------	---	---	
					Loblolly pine-------	88	127	
					White oak-----------	70	52	
					Scarlet oak---------	70	52	
LoD3------------ Loring	Moderate	Moderate	Slight	Severe	Yellow poplar-------	78	68	Loblolly pine, shortleaf pine.
					Southern red oak----	---	---	
					Black oak-----------	60	43	
					Loblolly pine-------	85	120	
					White oak-----------	60	43	
					Scarlet oak---------	60	43	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
LwD**:								
Lowell	Moderate	Moderate	Slight	Severe	Black oak	88	70	White ash, eastern white pine, white oak, northern red oak, yellow poplar.
					White ash	75	---	
					Hickory	---	---	
					Virginia pine	78	119	
					Black locust	77	---	
					Sugar maple	---	---	
					Northern red oak	---	---	
					Chinkapin oak	81	63	
Faywood	Moderate	Moderate	Slight	Moderate	Northern red oak	70	52	White oak, eastern white pine, white ash, northern red oak.
					Scarlet oak	72	54	
					White oak	60	43	
					Hickory	---	---	
					White ash	---	---	
					Chinkapin oak	---	---	
					Sugar maple	---	---	
					Southern red oak	---	---	
LwE**:								
Lowell	Moderate	Moderate	Slight	Severe	Black oak	88	70	White ash, eastern white pine, white oak, northern red oak, yellow poplar.
					White ash	75	---	
					Hickory	---	---	
					Virginia pine	78	119	
					Black locust	77	---	
					Sugar maple	---	---	
					Northern red oak	---	---	
					Chinkapin oak	81	63	
Faywood	Severe	Severe	Slight	Moderate	Northern red oak	70	52	White oak, eastern white pine, white ash, northern red oak.
					Scarlet oak	72	54	
					White oak	60	43	
					Hickory	---	---	
					White ash	---	---	
					Chinkapin oak	---	---	
					Sugar maple	---	---	
					Southern red oak	---	---	
Mc: McGary	Slight	Moderate	Slight	Severe	Pin oak	80	74	Eastern white pine, pin oak, baldcypress, American sycamore, loblolly pine, green ash.
					Sweetgum	---	---	
					White oak	64	47	
					Green ash	---	---	
					Red maple	---	---	
					Shellbark hickory	---	---	
					Hackberry	---	---	
					Post oak	66	48	
					Shumard oak	68	58	
					Black oak	67	49	
					Swamp white oak	---	---	
Me: Melvin	Slight	Moderate	Moderate	Severe	Pin oak	99	97	Pin oak, baldcypress, American sycamore, sweetgum, loblolly pine.
					Eastern cottonwood	101	130	
					Sweetgum	92	112	
					Green ash	---	---	
					Hackberry	---	---	
					Hickory	---	---	
					Red maple	---	---	
					American elm	---	---	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
MmB, MmC, MmC3-- Memphis	Slight	Slight	Slight	Severe	Yellow poplar-------	102	110	Cherrybark oak, black walnut, loblolly pine, sweetgum, yellow poplar, white ash.
					Cherrybark oak------	93	126	
					Sweetgum------------	90	106	
					White oak-----------	71	53	
MmD, MmD3------- Memphis	Moderate	Moderate	Slight	Severe	Yellow poplar-------	102	110	Yellow poplar, black walnut, white ash, sweetgum, cherrybark oak, loblolly pine.
					Cherrybark oak------	93	126	
					Sweetgum------------	90	106	
					White oak-----------	71	53	
Na-------------- Nelse	Slight	Moderate	Slight	Moderate	Sweetgum------------	98	132	Green ash, American sycamore, sweetgum.
					Boxelder------------	---	---	
					Silver maple--------	---	---	
					Black willow--------	---	---	
					River birch---------	---	---	
					Green ash-----------	---	---	
					American sycamore---	---	---	
Nb**:								
Nelse----------	Slight	Moderate	Slight	Moderate	Sweetgum------------	98	132	Green ash, American sycamore, sweetgum.
					Boxelder------------	---	---	
					Silver maple--------	---	---	
					Black willow--------	---	---	
					River birch---------	---	---	
					Green ash-----------	---	---	
					American sycamore---	---	---	
Huntington-----	Slight	Slight	Slight	Severe	Yellow poplar-------	95	98	Yellow poplar, northern red oak, black walnut, white ash, eastern white pine, loblolly pine.
					Northern red oak----	---	---	
					White oak-----------	---	---	
					Black walnut--------	70	---	
NcE**:								
Nelse----------	Slight	Moderate	Slight	Moderate	Sweetgum------------	98	132	Green ash, American sycamore, sweetgum.
					Boxelder------------	---	---	
					Silver maple--------	---	---	
					Black willow--------	---	---	
					River birch---------	---	---	
					Green ash-----------	---	---	
					American sycamore---	---	---	
Huntington-----	Slight	Slight	Slight	Severe	Yellow poplar-------	95	98	Yellow poplar, white ash, black walnut, loblolly pine, eastern white pine, northerr red oak.
					Northern red oak----	---	---	
					White oak-----------	---	---	
					Black walnut--------	70	---	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
NcE**:								
Wheeling	Slight	Slight	Slight	Severe	Northern red oak	80	62	Eastern white pine, yellow poplar, black walnut, northern red oak, loblolly pine, white oak.
					Yellow poplar	90	90	
Ne Newark	Slight	Moderate	Moderate	Severe	Pin oak	100	98	Eastern cottonwood, sweetgum, American sycamore, green ash.
					Eastern cottonwood	94	113	
					Sweetgum	85	93	
					Green ash	---	---	
					Cherrybark oak	---	---	
					Shumard oak	---	---	
					Overcup oak	---	---	
NhC Nicholson	Moderate	Slight	Slight	Severe	Black oak	78	60	White oak, northern red oak, sweetgum, yellow poplar, eastern white pine, white ash, loblolly pine.
					White oak	74	56	
					Hickory	---	---	
					Sweetgum	84	90	
					Yellow poplar	107	119	
					Northern red oak	79	61	
NhC3 Nicholson	Moderate	Slight	Slight	Severe	Black oak	70	52	White ash, white oak, eastern white pine, loblolly pine.
					White ash	---	---	
					Sugar maple	---	---	
					White oak	---	---	
					Hickory	---	---	
					Southern red oak	---	---	
NhD Nicholson	Moderate	Moderate	Slight	Severe	Black oak	78	60	White oak, northern red oak, sweetgum, yellow poplar, white ash, eastern white pine, loblolly pine.
					White oak	74	56	
					Hickory	---	---	
					Sweetgum	84	90	
					Yellow poplar	107	119	
					Northern red oak	79	61	
NhD3 Nicholson	Moderate	Moderate	Slight	Severe	Black oak	70	52	White ash, white oak, eastern white pine, loblolly pine.
					White ash	---	---	
					Sugar maple	---	---	
					White oak	---	---	
					Hickory	---	---	
					Southern red oak	---	---	
No Nolin	Slight	Slight	Moderate	Severe	Yellow poplar	107	119	Eastern cottonwood, black walnut, white ash, yellow poplar, cherrybark oak, sweetgum, pin oak, eastern white pine.
					Sweetgum	---	---	
					Cherrybark oak	97	140	
					Eastern cottonwood	---	---	
					River birch	---	---	
					Black willow	---	---	
					American sycamore			

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns				Potential productivity			Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Volume*	
OtB, OtC3------- Otwell	Slight	Slight	Slight	Severe	Yellow poplar------- White oak----------- Sugar maple--------- Black oak----------- Southern red oak----	95 69 --- 72 ---	98 51 --- 54 ---	Eastern white pine, yellow poplar, white ash, loblolly pine.
Pe-------------- Peoga	Slight	Severe	Severe	Severe	Pin oak------------- White oak----------- Sweetgum------------	90 75 90	86 57 106	Baldcypress, green ash, sweetgum, pin oak.
SaE------------- Saffell	Moderate	Moderate	Moderate	Moderate	Black oak----------- White oak----------- Chestnut oak-------- Scarlet oak--------- Hickory------------- Post oak------------	60 55 47 56 --- ---	43 38 32 39 --- ---	Loblolly pine, shortleaf pine, white oak.
WfE**:								
Wellston------- (warm aspect)	Moderate	Moderate	Moderate	Severe	Black oak----------- Virginia pine------- White oak----------- Scarlet oak--------- Post oak------------ Hickory-------------	73 70 69 71 --- ---	55 109 51 53 --- ---	Loblolly pine, shortleaf pine, white oak.
Frondorf------- (warm aspect)	Moderate	Moderate	Moderate	Moderate	White oak----------- Post oak------------ Scarlet oak--------- Southern red oak---- Hickory------------- Black oak-----------	68 73 --- --- --- 70	50 55 --- --- --- 50	Loblolly pine, shortleaf pine, white oak.
WfE**:								
Wellston------- (cool aspect)	Moderate	Moderate	Slight	Severe	Black oak----------- Yellow poplar------- Virginia pine------- White oak----------- Black walnut-------- Black cherry-------- Sugar maple--------- White ash----------- Chestnut oak--------	81 93 68 74 --- --- --- --- 78	63 95 105 56 --- --- --- --- 60	Eastern white pine, black walnut, yellow poplar, white oak, northern red oak, loblolly pine, shortleaf pine, white ash.
Frondorf------- (cool aspect)	Moderate	Moderate	Slight	Moderate	White oak----------- Black oak----------- Yellow poplar------- Hickory------------- Virginia pine-------	74 76 --- --- 72	56 58 --- --- 112	Yellow poplar, shortleaf pine, white oak, eastern white pine, loblolly pine, northern red oak.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Potential productivity: Common trees	Site index	Volume*	Trees to plant
WhA, WhB, WhC---Wheeling	Slight	Slight	Slight	Severe	Northern red oak----	80	62	Eastern white pine, yellow poplar, black walnut, northern red oak, white oak, loblolly pine.
					Yellow poplar-------	90	90	
WhD------------Wheeling	Moderate	Moderate	Slight	Severe	Northern red oak----	80	62	Eastern white pine, yellow poplar, black walnut, northern red oak, white oak, loblolly pine.
					Yellow poplar-------	90	90	
ZaC------------Zanesville	Slight	Slight	Slight	Severe	Virginia pine-------	66	102	Yellow poplar, white ash, white oak, northern red oak, eastern white pine, shortleaf pine.
					Black oak-----------	75	57	
					White oak-----------	69	51	
					Hickory-------------	---	---	
					Yellow poplar-------	90	90	
					Sweetgum------------	---	---	
					Eastern white pine--	81	146	
ZaC3-----------Zanesville	Slight	Slight	Moderate	Slight	Virginia pine-------	60	91	Virginia pine, shortleaf pine, eastern white pine, white oak.
					Black oak-----------	60	43	
					White oak-----------	60	43	
					Scarlet oak---------	---	---	
					Black locust--------	---	---	
					Post oak------------	---	---	
ZaD------------Zanesville	Moderate	Moderate	Slight	Severe	Virginia pine-------	66	102	Yellow poplar, white ash, white oak, northern red oak, eastern white pine, shortleaf pine.
					Black oak-----------	75	57	
					White oak-----------	69	51	
					Hickory-------------	---	---	
					Yellow poplar-------	90	90	
					Sweetgum------------	---	---	
					Eastern white pine--	81	146	
ZaD3-----------Zanesville	Moderate	Moderate	Slight	Moderate	Virginia pine-------	60	91	Virginia pine, shortleaf pine, eastern white pine, white oak.
					Black oak-----------	60	43	
					White oak-----------	60	43	
					Scarlet oak---------	---	---	
					Black locust--------	---	---	
					Post oak------------	---	---	

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AsA------------------- Ashton	Severe: flooding.	Slight----------	Moderate: slope, flooding.	Slight----------	Moderate: flooding.
BaE------------------- Baxter	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
BrC, BrC3------------- Brandon	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
BrD, BrD3------------- Brandon	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
ChB------------------- Chavies	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Slight.
ChD------------------- Chavies	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
Du-------------------- Dunning	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
EkA------------------- Elk	Slight----------	Slight----------	Slight----------	Severe: erodes easily.	Slight.
EkB------------------- Elk	Slight----------	Slight----------	Moderate: slope.	Severe: erodes easily.	Slight.
EkC------------------- Elk	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
FrD, FrD3------------- Frondorf	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
FrE------------------- Frondorf	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
HaC, HaC3------------- Hammack	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
HaD, HaD3------------- Hammack	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Hn-------------------- Henshaw	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
Hu-------------------- Huntington	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Ka-------------------- Karnak	Severe: flooding, wetness, percs slowly.	Severe: wetness, flooding, percs slowly.	Severe: too clayey, wetness, flooding.	Severe: wetness, too clayey.	Severe: wetness, flooding, too clayey.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
LcB: Licking	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
LkC3: Licking	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope, wetness.
Ln: Lindside	Severe: flooding.	Moderate: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding.	Severe: flooding.
LoB: Loring	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight	Slight.
LoC, LoC3: Loring	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
LoD, LoD3: Loring	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
LwD*:					
Lowell	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Faywood	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
LwE*:					
Lowell	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Faywood	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Mc: McGary	Severe: flooding, wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
Me: Melvin	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
MmB: Memphis	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
MmC, MmC3: Memphis	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
MmD, MmD3: Memphis	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Na: Nelse	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Nb*:					
Nelse	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Huntington	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
NcE*:					
Nelse	Severe: flooding.	Moderate: slope, flooding.	Severe: slope, flooding.	Moderate: flooding.	Severe: flooding.
Huntington	Severe: flooding.	Moderate: slope, flooding.	Severe: slope, flooding.	Moderate: flooding.	Severe: flooding.
Wheeling	Severe: flooding, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ne: Newark	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
NhC, NhC3: Nicholson	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: wetness, slope.
NhD, NhD3: Nicholson	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
No: Nolin	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Severe: erodes easily.	Severe: flooding.
OtB: Otwell	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
OtC3: Otwell	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope.
Pe: Peoga	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Pt*. Pits, quarries					
Pu*:					
Pits.					
Udorthents.					
SaE: Saffell	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
WfE*:					
Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Frondorf	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
WhA Wheeling	Slight	Slight	Slight	Slight	Slight.
WhB Wheeling	Slight	Slight	Moderate: slope.	Slight	Slight.
WhC Wheeling	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
WhD Wheeling	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
ZaC, ZaC3 Zanesville	Moderate: slope, percs slowly, wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
ZaD, ZaD3 Zanesville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
AsA: Ashton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BaE: Baxter	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
BrC, BrC3: Brandon	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
BrD, BrD3: Brandon	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
ChB: Chavies	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ChD: Chavies	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Du: Dunning	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
EkA, EkB: Elk	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
EkC: Elk	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
FrD, FrD3: Frondorf	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
FrE: Frondorf	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
HaC, HaC3: Hammack	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
HaD, HaD3: Hammack	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Hn: Henshaw	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Hu: Huntington	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Ka: Karnak	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
LcB: Licking	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
LkC3: Licking	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Ln: Lindside	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
LoB Loring	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
LoC, LoC3 Loring	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
LoD, LoD3 Loring	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
LwD*:										
Lowell	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Faywood	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
LwE*:										
Lowell	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Faywood	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Mc McGary	Fair	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
Me Melvin	Poor	Poor	Poor	Fair	Fair	Good	Good	Poor	Fair	Good.
MmB Memphis	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MmC, MmC3 Memphis	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MmD, MmD3 Memphis	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Na Nelse	Fair	Good	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
Nb*:										
Nelse	Fair	Good	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
Huntington	Good	Good	Fair	Good	Good	Poor	Very poor.	Good	Good	Very poor.
NcE*:										
Nelse	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Huntington	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Wheeling	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Ne------------------ Newark	Fair	Good	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
NhC, NhC3---------- Nicholson	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
NhD, NhD3---------- Nicholson	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
No------------------ Nolin	Good	Good	Fair	Good	Good	Poor	Very poor.	Good	Good	Very poor.
OtB----------------- Otwell	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
OtC3---------------- Otwell	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Pe------------------ Peoga	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Pt*. Pits, quarries										
Pu*: Pits.										
Udorthents.										
SaE----------------- Saffell	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
WfE*: Wellston----------	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Frondorf----------	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
WhA----------------- Wheeling	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WhB----------------- Wheeling	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WhC----------------- Wheeling	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
WhD----------------- Wheeling	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
ZaC, ZaC3---------- Zanesville	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
ZaD, ZaD3---------- Zanesville	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AsA: Ashton	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, low strength.	Moderate: flooding.
BaE: Baxter	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
BrC, BrC3: Brandon	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
BrD, BrD3: Brandon	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
ChB: Chavies	Slight	Slight	Slight	Moderate: slope.	Slight	Slight.
ChD: Chavies	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
Du: Dunning	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding, too clayey.
EkA: Elk	Slight	Slight	Slight	Slight	Severe: low strength.	Slight.
EkB: Elk	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
EkC: Elk	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
FrD, FrD3, FrE: Frondorf	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
HaC, HaC3: Hammack	Moderate: too clayey, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
HaD, HaD3: Hammack	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Hn: Henshaw	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: low strength.	Moderate: wetness.
Hu: Huntington	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ka---------------- Karnak	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, flooding, too clayey.
LcB--------------- Licking	Moderate: wetness, too clayey.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
LkC3-------------- Licking	Moderate: wetness, slope, too clayey.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: slope, wetness.
Ln---------------- Lindside	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, low strength.	Severe: flooding.
LoB--------------- Loring	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Severe: low strength.	Slight.
LoC, LoC3--------- Loring	Severe: wetness.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Severe: low strength.	Moderate: slope.
LoD, LoD3--------- Loring	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
LwD*, LwE*:						
Lowell-----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Faywood----------	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
Mc---------------- McGary	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
Me---------------- Melvin	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
MmB--------------- Memphis	Slight---------	Slight---------	Slight---------	Moderate: slope.	Severe: low strength.	Slight.
MmC, MmC3--------- Memphis	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
MmD, MmD3--------- Memphis	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Na---------------- Nelse	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Nb*:						
Nelse	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Huntington	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, low strength.	Severe: flooding.
NcE*:						
Nelse	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding, slope.	Severe: flooding.	Severe: flooding.
Huntington	Moderate: flooding, slope.	Severe: flooding.	Severe: flooding.	Severe: slope, flooding.	Severe: flooding, low strength.	Severe: flooding.
Wheeling	Severe: slope.	Severe: flooding, slope.	Severe: flooding, slope.	Severe: flooding, slope.	Severe: slope.	Severe: slope.
Ne Newark	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
NhC, NhC3 Nicholson	Severe: wetness.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Severe: low strength.	Moderate: wetness, slope.
NhD, NhD3 Nicholson	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
No Nolin	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
OtB Otwell	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Severe: low strength.	Moderate: wetness.
OtC3 Otwell	Severe: wetness.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Severe: low strength.	Moderate: slope, wetness.
Pe Peoga	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness.	Severe: wetness.
Pt*. Pits, quarries						
Pu*:						
Pits.						
Udorthents.						

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
SaE--------------- Saffell	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
WfE*:						
Wellston---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
Frondorf---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
WhA--------------- Wheeling	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: low strength.	Slight.
WhB--------------- Wheeling	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: low strength.	Slight.
WhC--------------- Wheeling	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope.	Moderate: slope.
WhD--------------- Wheeling	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
ZaC, ZaC3--------- Zanesville	Moderate: slope, wetness, depth to rock.	Moderate: slope, wetness.	Severe: wetness.	Severe: slope.	Severe: low strength.	Moderate: slope.
ZaD, ZaD3--------- Zanesville	Severe: slope.	Severe: slope.	Severe: slope, wetness.	Severe: slope.	Severe: low strength, slope.	Severe: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AsA----------------- Ashton	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
BaE----------------- Baxter	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, slope, hard to pack.
BrC, BrC3----------- Brandon	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: small stones.
BrD, BrD3----------- Brandon	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: small stones, slope.
ChB----------------- Chavies	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
ChD----------------- Chavies	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope.
Du------------------ Dunning	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
EkA----------------- Elk	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
EkB----------------- Elk	Moderate: percs slowly.	Moderate: seepage,	Moderate: too clayey.	Slight-----------	Fair: too clayey.
EkC----------------- Elk	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
FrD, FrD3, FrE------ Frondorf	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
HaC, HaC3----------- Hammack	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
HaD, HaD3----------- Hammack	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Hn------------------ Henshaw	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Hu------------------ Huntington	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
Ka------------------ Karnak	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
LcB----------------- Licking	Severe: wetness, percs slowly.	Moderate: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, hard to pack.
LkC3---------------- Licking	Severe: wetness, percs slowly.	Severe: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, hard to pack.
Ln------------------ Lindside	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
LoB----------------- Loring	Severe: wetness, percs slowly.	Moderate: slope.	Moderate: wetness.	Moderate: wetness.	Fair: wetness.
LoC, LoC3----------- Loring	Severe: wetness, percs slowly.	Severe: slope.	Moderate: wetness, slope.	Moderate: wetness, slope.	Moderate: wetness, slope.
LoD, LoD3----------- Loring	Severe: wetness, percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
LwD*, LwE*:					
Lowell-------------	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Faywood------------	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: slope, depth to rock, too clayey.	Severe: slope, depth to rock.	Poor: depth to rock, too clayey, hard to pack.
Mc------------------ McGary	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Me------------------ Melvin	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
MmB----------------- Memphis	Slight-----------	Moderate: seepage, slope.	Slight-----------	Slight-----------	Good.
MmC, MmC3----------- Memphis	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
MmD, MmD3----------- Memphis	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Na----------------- Nelse	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage.	Fair: too sandy.
Nb*:					
Nelse--------------	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage.	Fair: too sandy.
Huntington---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
NcE*:					
Nelse--------------	Severe: flooding, poor filter.	Severe: seepage, flooding, slope.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage.	Fair: too sandy, slope.
Huntington---------	Severe: flooding.	Severe: slope, flooding.	Severe: flooding.	Severe: flooding.	Fair: slope.
Wheeling-----------	Severe: poor filter, slope.	Severe: slope, flooding, seepage.	Severe: slope, seepage.	Severe: slope.	Poor: slope.
Ne----------------- Newark	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
NhC, NhC3----------- Nicholson	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness, too clayey.	Moderate: wetness, slope.	Fair: too clayey, wetness, slope.
NhD, NhD3----------- Nicholson	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: wetness, slope.	Severe: slope.	Poor: slope.
No----------------- Nolin	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey.
OtB---------------- Otwell	Severe: wetness, percs slowly.	Moderate: slope.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
OtC3--------------- Otwell	Severe: wetness, percs slowly.	Severe: slope.	Moderate: wetness, slope, too clayey.	Moderate: wetness, slope.	Fair: too clayey, slope, wetness.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Pe------------------ Peoga	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness.	Severe: wetness.	Poor: wetness.
Pt*. Pits, quarries					
Pu*: Pits.					
Udorthents.					
SaE----------------- Saffell	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: small stones, slope.
WfE*: Wellston-----------	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
Frondorf-----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
WhA, WhB------------ Wheeling	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Slight-----------	Fair: too clayey.
WhC----------------- Wheeling	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Fair: slope, too clayey.
WhD----------------- Wheeling	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: slope.
ZaC, ZaC3----------- Zanesville	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: depth to rock.	Moderate: depth to rock, slope, wetness.	Fair: slope, too clayey, wetness.
ZaD, ZaD3----------- Zanesville	Severe: slope, percs slowly, wetness.	Severe: slope, wetness.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AsA: Ashton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
BaE: Baxter	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
BrC, BrC3: Brandon	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
BrD, BrD3: Brandon	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
ChB: Chavies	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
ChD: Chavies	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Du: Dunning	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
EkA, EkB: Elk	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
EkC: Elk	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
FrD, FrD3: Frondorf	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
FrE: Frondorf	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
HaC, HaC3: Hammack	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
HaD, HaD3: Hammack	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Hn-------------------- Henshaw	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Hu-------------------- Huntington	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ka-------------------- Karnak	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
LcB, LkC3------------- Licking	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Ln-------------------- Lindside	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
LoB------------------- Loring	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
LoC, LoC3------------- Loring	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
LoD, LoD3------------- Loring	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
LwD*:				
Lowell---------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Faywood--------------	Poor: low strength, depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey.
LwE*:				
Lowell---------------	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Faywood--------------	Poor: slope, low strength, depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey.
Mc-------------------- McGary	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Me-------------------- Melvin	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
MmB------------------- Memphis	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
MmC, MmC3------------- Memphis	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
MmD, MmD3: Memphis	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Na: Nelse	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Nb*:				
Nelse	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Huntington	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
NcE*:				
Nelse	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, slope.
Huntington	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Wheeling	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Ne: Newark	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
NhC, NhC3: Nicholson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
NhD, NhD3: Nicholson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
No: Nolin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
OtB: Otwell	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
OtC3: Otwell	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
Pe: Peoga	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Pt*. Pits, quarries				
Pu*:				
Pits.				
Udorthents.				

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
SaE-------------------- Saffell	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
WfE*:				
Wellston-------------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Frondorf-------------	Poor: slope, depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
WhA, WhB-------------- Wheeling	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
WhC-------------------- Wheeling	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, too clayey.
WhD-------------------- Wheeling	Fair: slope, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
ZaC, ZaC3------------- Zanesville	Severe: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
ZaD, ZaD3------------- Zanesville	Severe: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
AsA: Ashton	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily.
BaE: Baxter	Severe: slope.	Moderate: hard to pack.	Deep to water	Slope	Slope.
BrC, BrC3, BrD, BrD3: Brandon	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope	Slope.
ChB: Chavies	Severe: seepage.	Severe: piping.	Deep to water	Favorable	Favorable.
ChD: Chavies	Severe: seepage, slope.	Severe: piping.	Deep to water	Soil blowing	Slope.
Du: Dunning	Slight	Severe: wetness.	Percs slowly, flooding.	Wetness, percs slowly.	Wetness, percs slowly.
EkA: Elk	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable.
EkB: Elk	Moderate: seepage, slope.	Severe: piping.	Deep to water	Favorable	Favorable.
EkC: Elk	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope.
FrD, FrD3, FrE: Frondorf	Severe: slope.	Severe: piping.	Deep to water	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
HaC, HaC3, HaD, HaD3: Hammack	Severe: slope.	Severe: piping.	Deep to water	Slope, large stones.	Slope, large stones.
Hn: Henshaw	Moderate: seepage.	Severe: piping, wetness.	Favorable	Erodes easily, wetness.	Wetness, erodes easily.
Hu: Huntington	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable.
Ka: Karnak	Slight	Severe: hard to pack, wetness.	Percs slowly, flooding.	Wetness, percs slowly.	Wetness, percs slowly.
LcB: Licking	Moderate: slope.	Severe: hard to pack.	Percs slowly, slope.	Wetness	Percs slowly.
LkC3: Licking	Severe: slope.	Severe: hard to pack.	Percs slowly, slope.	Slope, wetness.	Slope, percs slowly.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
Ln---------------- Lindside	Moderate: seepage.	Severe: piping.	Flooding---------	Wetness, erodes easily.	Erodes easily.
LoB--------------- Loring	Moderate: seepage, slope.	Moderate: piping, wetness.	Slope, percs slowly.	Erodes easily, wetness, rooting depth.	Erodes easily, rooting depth.
LoC, LoC3, LoD, LoD3------------- Loring	Severe: slope.	Moderate: piping, wetness.	Slope, percs slowly.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
LwD*:					
Lowell-----------	Severe: slope.	Severe: hard to pack.	Deep to water----	Slope------------	Slope.
Faywood----------	Severe: slope.	Severe: thin layer, hard to pack.	Deep to water----	Slope, depth to rock.	Slope, depth to rock.
LwE*:					
Lowell-----------	Severe: slope.	Severe: hard to pack.	Deep to water----	Slope------------	Slope.
Faywood----------	Severe: slope.	Severe: thin layer, hard to pack.	Deep to water----	Slope, depth to rock.	Slope, depth to rock.
Mc---------------- McGary	Slight------------	Severe: wetness.	Percs slowly-----	Wetness, percs slowly.	Wetness, percs slowly.
Me---------------- Melvin	Moderate: seepage.	Severe: piping, wetness.	Flooding---------	Erodes easily, wetness.	Wetness, erodes easily.
MmB--------------- Memphis	Moderate: seepage, slope.	Severe: piping.	Deep to water----	Erodes easily----	Erodes easily.
MmC, MmC3, MmD, MmD3------------- Memphis	Severe: slope.	Severe: piping.	Deep to water----	Slope, erodes easily.	Slope, erodes easily.
Na---------------- Nelse	Severe: seepage.	Severe: seepage, piping.	Deep to water----	Favorable--------	Favorable.
Nb*:					
Nelse------------	Severe: seepage.	Severe: seepage, piping.	Deep to water----	Favorable--------	Favorable.
Huntington-------	Moderate: seepage.	Severe: piping.	Deep to water----	Favorable--------	Favorable.
NcE*:					
Nelse------------	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water----	Slope------------	Slope.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
NcE*:					
Huntington	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope.
Wheeling	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope.
Ne Newark	Moderate: seepage.	Severe: piping, wetness.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
NhC, NhC3, NhD, NhD3 Nicholson	Severe: slope.	Moderate: hard to pack, wetness.	Percs slowly, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
No Nolin	Severe: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily.
OtB Otwell	Moderate: slope.	Moderate: thin layer, wetness.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.
OtC3 Otwell	Severe: slope.	Moderate: thin layer, wetness.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
Pe Peoga	Slight	Severe: wetness.	Percs slowly, frost action.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Pt*. Pits, quarries					
Pu*:					
Pits.					
Udorthents.					
SaE Saffell	Severe: slope, seepage.	Severe: seepage.	Deep to water	Slope	Slope, droughty.
WfE*:					
Wellston	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Frondorf	Severe: slope.	Severe: piping.	Deep to water	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
WhA Wheeling	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable.
WhB Wheeling	Moderate: seepage, slope.	Severe: piping.	Deep to water	Favorable	Favorable.
WhC, WhD Wheeling	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
ZaC, ZaC3, ZaD, ZaD3------------- Zanesville	Severe: slope.	Severe: piping.	Percs slowly, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
AsA-------------- Ashton	0-10	Silt loam--------	ML	A-4	0	95-100	95-100	75-100	60-95	<35	NP-10
	10-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	95-100	95-100	85-100	80-100	25-42	5-20
BaE-------------- Baxter	0-8	Gravelly silt loam.	ML, GM, CL-ML, GM-GC	A-4	0-10	60-90	55-80	45-70	45-70	25-35	4-10
	8-27	Gravelly silty clay loam, gravelly silt loam.	CL, SM-SC, GC, CL-ML	A-4, A-6	0-10	60-90	55-80	55-80	45-80	25-40	5-20
	27-64	Gravelly silty clay, gravelly clay.	CH, CL, GC, SC	A-7	0-10	55-90	45-85	45-85	45-80	40-60	20-35
BrC-------------- Brandon	0-6	Silt loam--------	ML, CL, CL-ML	A-4	0	100	95-100	90-100	85-100	<30	NP-10
	6-34	Silty clay loam, silt loam.	CL	A-6, A-7-6	0	95-100	90-100	85-100	75-100	35-48	15-25
	34-60	Very gravelly fine sandy loam, very gravelly silt loam, gravelly clay loam.	SC, GC, GM-GC, SM-SC	A-2, A-4, A-1, A-6	0-5	30-70	30-60	15-55	10-50	10-38	5-20
BrC3------------- Brandon	0-5	Silt loam--------	ML, CL, CL-ML	A-4	0	100	95-100	90-100	85-100	<30	NP-10
	5-36	Silty clay loam, silt loam.	CL	A-6, A-7-6	0	95-100	90-100	85-100	75-100	35-48	15-25
	36-60	Very gravelly fine sandy loam, very gravelly silt loam, gravelly clay loam.	SC, GC, GM-GC, SM-SC	A-2, A-4, A-1, A-6	0-5	30-70	30-60	15-55	10-50	10-38	5-20
BrD-------------- Brandon	0-6	Silt loam--------	ML, CL, CL-ML	A-4	0	100	95-100	90-100	85-100	<30	NP-10
	6-34	Silty clay loam, silt loam.	CL	A-6, A-7-6	0	95-100	90-100	85-100	75-100	35-48	15-25
	34-60	Very gravelly fine sandy loam, very gravelly silt loam, gravelly clay loam.	SC, GC, GM-GC, SM-SC	A-2, A-4, A-1, A-6	0-5	30-70	30-60	15-55	10-50	10-38	5-20
BrD3------------- Brandon	0-5	Silt loam--------	ML, CL, CL-ML	A-4	0	100	95-100	90-100	85-100	<30	NP-10
	5-36	Silty clay loam, silt loam.	CL	A-6, A-7-6	0	95-100	90-100	85-100	75-100	35-48	15-25
	36-60	Very gravelly fine sandy loam, very gravelly silt loam, gravelly clay loam.	SC, GC, GM-GC, SM-SC	A-2, A-4, A-1, A-6	0-5	30-70	30-60	15-55	10-50	10-38	5-20

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
ChB, ChD--------- Chavies	0-14	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4	0	85-100	75-100	40-90	40-75	<25	NP-5
	14-60	Fine sandy loam, silt loam, loam.	SM, ML	A-4	0	85-100	75-100	65-100	45-85	<35	NP-8
Du--------------- Dunning	0-7	Silty clay-------	CL, CH	A-6, A-7	0	100	95-100	90-100	85-95	34-55	15-25
	7-62	Silty clay, clay, silty clay loam.	CH, CL	A-7	0-5	90-100	90-100	80-100	70-100	45-70	20-40
EkA, EkB, EkC---- Elk	0-9	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	95-100	85-100	70-95	25-35	3-10
	9-76	Silty clay loam, silt loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	75-100	25-40	5-15
	76-96	Silty clay loam, silt loam, silty clay.	ML, CL, CL-ML, SM-SC	A-4, A-6	0	95-100	95-100	45-100	40-95	25-40	5-15
FrD-------------- Frondorf	0-8	Silt loam--------	ML, CL, CL-ML	A-4	0-5	85-100	80-100	80-100	75-100	25-35	5-10
	8-37	Channery silty clay loam, channery silt loam, channery loam.	ML, CL, GM, GC	A-4, A-6, A-2, A-7	10-40	55-90	50-85	40-80	30-75	<45	NP-25
	37	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
FrD3------------- Frondorf	0-2	Silt loam--------	ML, CL, CL-ML	A-4	0-5	85-100	80-100	80-100	75-100	25-35	5-10
	2-27	Channery silty clay loam, channery silt loam, channery loam.	ML, CL, GM, GC	A-4, A-6, A-2, A-7	10-40	55-90	50-85	40-80	30-75	<45	NP-25
	27	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
FrE-------------- Frondorf	0-8	Silt loam--------	ML, CL, CL-ML	A-4	0-5	85-100	80-100	80-100	75-100	25-35	5-10
	8-37	Channery silty clay loam, channery silt loam, channery loam.	ML, CL, GM, GC	A-4, A-6, A-2, A-7	10-40	55-90	50-85	40-80	30-75	<45	NP-25
	37	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
HaC-------------- Hammack	0-7	Silt loam--------	ML, CL, CL-ML	A-4	0	100	95-100	90-100	85-100	25-35	4-10
	7-28	Silt loam, silty clay loam.	ML, CL	A-6, A-7, A-4	0	100	95-100	90-100	85-95	30-45	6-20
	28-40	Very gravelly silt loam, very gravelly silty clay loam.	GM, GC, ML, CL	A-6, A-7, A-4, A-2	15-35	25-80	25-75	22-75	18-70	30-45	6-20
	40-76	Very gravelly silty clay, very gravelly clay, gravelly clay.	GC, CL, CH	A-7, A-2	10-40	40-100	30-100	30-70	25-70	45-70	20-40

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
HaC3------------- Hammack	0-6	Silt loam--------	ML, CL, CL-ML	A-4	0	100	95-100	90-100	85-100	25-35	4-10
	6-13	Silt loam, silty clay loam.	ML, CL	A-6, A-7, A-4	0	100	95-100	90-100	85-95	30-45	6-20
	13-22	Very gravelly silt loam, very gravelly silty clay loam.	GM, GC, ML, CL	A-6, A-7, A-4, A-2	15-35	25-80	25-75	22-75	18-70	30-45	6-20
	22-60	Very gravelly silty clay, very gravelly clay, gravelly clay.	GC, CL, CH	A-7, A-2	10-40	40-100	30-100	30-70	25-70	45-70	20-40
HaD-------------- Hammack	0-7	Silt loam--------	ML, CL, CL-ML	A-4	0	100	95-100	90-100	85-100	25-35	4-10
	7-28	Silt loam, silty clay loam.	ML, CL	A-6, A-7, A-4	0	100	95-100	90-100	85-95	30-45	6-20
	28-40	Very gravelly silt loam, very gravelly silty clay loam.	GM, GC, ML, CL	A-6, A-7, A-4, A-2	15-35	25-80	25-75	22-75	18-70	30-45	6-20
	40-76	Very gravelly silty clay, very gravelly clay, gravelly clay.	GC, CL, CH	A-7, A-2	10-40	40-100	30-100	30-70	25-70	45-70	20-40
HaD3------------- Hammack	0-6	Silt loam--------	ML, CL, CL-ML	A-4	0	100	95-100	90-100	85-100	25-35	4-10
	6-13	Silt loam, silty clay loam.	ML, CL	A-6, A-7, A-4	0	100	95-100	90-100	85-95	30-45	6-20
	13-22	Very gravelly silt loam, very gravelly silty clay loam.	GM, GC, ML, CL	A-6, A-7, A-4, A-2	15-35	25-80	25-75	22-75	18-70	30-45	6-20
	22-60	Very gravelly silty clay, very gravelly clay, gravelly clay.	GC, CL, CH	A-7, A-2	10-40	40-100	30-100	30-70	25-70	45-70	20-40
Hn--------------- Henshaw	0-6	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	95-100	90-100	80-100	20-35	3-10
	6-63	Silty clay loam, silt loam.	CL	A-6, A-4	0	95-100	95-100	95-100	85-100	30-40	8-18
Hu--------------- Huntington	0-13	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-95	25-40	5-15
	13-70	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-95	25-40	5-15
	70-84	Stratified fine sand to silty clay loam.	SM, SC, ML, CL	A-2, A-4	0-10	95-100	95-100	50-90	30-75	<30	NP-10
Ka--------------- Karnak	0-4	Silty clay-------	CH, CL, MH, ML	A-7	0	100	100	95-100	95-100	45-80	20-40
	4-62	Silty clay, clay	CH, MH, CL, ML	A-7	0	100	100	95-100	95-100	45-80	20-40
LcB-------------- Licking	0-6	Silt loam--------	ML, CL-ML, CL	A-4	0	95-100	95-100	90-100	70-90	22-35	4-10
	6-12	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	90-100	80-95	30-50	15-25
	12-60	Silty clay, clay	CH, CL	A-7	0	100	100	95-100	75-95	45-70	26-42
	60-75	Clay, silty clay, silt loam.	CH, CL, ML, MH	A-7	0	100	100	90-100	70-95	45-70	20-36

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
LkC3------------- Licking	0-3	Silty clay loam	CL	A-4, A-6, A-7	0	95-100	95-100	90-100	80-95	27-45	8-22
	3-36	Silty clay, clay	CH, CL	A-7	0	100	100	95-100	75-95	45-70	26-42
	36-63	Clay, silty clay, silt loam.	CH, CL, ML, MH	A-7	0	100	100	90-100	70-95	45-70	20-36
Ln--------------- Lindside	0-5	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	80-100	55-90	20-35	2-15
	5-34	Silty clay loam, silt loam, very fine sandy loam.	CL, ML, CL-ML	A-4, A-6	0	100	95-100	90-100	70-95	25-40	4-18
	34-85	Stratified silty clay loam to gravelly sandy loam.	CL, ML, SM, SC	A-2, A-4, A-6	0	95-100	95-100	45-100	30-95	20-40	4-18
LoB, LoC--------- Loring	0-9	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	<35	NP-15
	9-26	Silt loam, silty clay loam.	CL, ML	A-6, A-7, A-4	0	100	100	95-100	90-100	32-48	10-20
	26-55	Silt loam, silty clay loam.	CL, ML	A-4, A-6, A-7	0	100	100	95-100	90-100	30-45	10-22
	55-65	Silt loam--------	CL, ML	A-4, A-6	0	100	100	95-100	70-100	28-40	7-16
LoC3------------- Loring	0-6	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	<35	NP-15
	6-14	Silt loam, silty clay loam.	CL, ML	A-6, A-7, A-4	0	100	100	95-100	90-100	32-48	10-20
	14-70	Silt loam, silty clay loam.	CL, ML	A-4, A-6, A-7	0	100	100	95-100	90-100	30-45	10-22
LoD-------------- Loring	0-9	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	<35	NP-15
	9-26	Silt loam, silty clay loam.	CL, ML	A-6, A-7, A-4	0	100	100	95-100	90-100	32-48	10-20
	26-55	Silt loam, silty clay loam.	CL, ML	A-4, A-6, A-7	0	100	100	95-100	90-100	30-45	10-22
	55-65	Silt loam--------	CL, ML	A-4, A-6	0	100	100	95-100	70-100	28-40	7-16
LoD3------------- Loring	0-6	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	<35	NP-15
	6-14	Silt loam, silty clay loam.	CL, ML	A-6, A-7, A-4	0	100	100	95-100	90-100	32-48	10-20
	14-70	Silt loam, silty clay loam.	CL, ML	A-4, A-6, A-7	0	100	100	95-100	90-100	30-45	10-22
LwD*, LwE*:											
Lowell-----------	0-4	Silt loam--------	ML, CL, CL-ML	A-4	0	100	95-100	90-100	85-100	22-32	3-10
	4-23	Silty clay, clay, silty clay loam.	CL, CH, MH	A-7, A-6	0	100	95-100	90-100	85-100	35-65	15-32
	23-44	Clay, silty clay	CH, MH, CL	A-7	0-10	90-100	75-100	75-100	75-100	45-75	20-40
	44	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Faywood---------	0-5	Silty clay loam	CL	A-6, A-7	0-15	100	95-100	90-100	85-100	34-42	15-22
	5-36	Silty clay, clay, silty clay loam.	CH, CL	A-7	0-15	80-100	65-100	65-100	65-100	42-70	20-45
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
Mc--------------- McGary	0-7	Silt loam---------	CL-ML, CL	A-4, A-6	0	100	100	90-100	70-90	25-36	5-15
	7-72	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	90-100	42-62	20-40
Me--------------- Melvin	0-9	Silt loam---------	CL, CL-ML, ML	A-4	0	95-100	95-100	80-100	80-95	25-35	4-10
	9-30	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	80-100	80-98	25-40	5-20
	30-62	Silt loam, silty clay loam, loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	80-100	60-98	25-40	5-20
MmB, MmC--------- Memphis	0-7	Silt loam---------	ML, CL-ML, CL	A-4	0	100	100	100	90-100	<30	NP-10
	7-88	Silt loam---------	ML, CL	A-4, A-6	0	100	100	100	90-100	30-43	6-19
MmC3------------- Memphis	0-2	Silt loam---------	ML, CL-ML, CL	A-4	0	100	100	100	90-100	<30	NP-10
	2-84	Silt loam---------	ML, CL	A-4, A-6	0	100	100	100	90-100	30-43	6-19
MmD-------------- Memphis	0-7	Silt loam---------	ML, CL-ML, CL	A-4	0	100	100	100	90-100	<30	NP-10
	7-88	Silt loam---------	ML, CL	A-4, A-6	0	100	100	100	90-100	30-43	6-19
MmD3------------- Memphis	0-2	Silt loam---------	ML, CL-ML, CL	A-4	0	100	100	100	90-100	<30	NP-10
	2-84	Silt loam---------	ML, CL	A-4, A-6	0	100	100	100	90-100	30-43	6-19
Na--------------- Nelse	0-18	Loam-------------	SM-SC, SM, CL-ML, ML	A-2-4, A-4	0-5	95-100	95-100	65-90	30-65	<25	NP-5
	18-26	Fine sandy loam, loam, loamy fine sand.	SM, SM-SC	A-2-4, A-4	0-5	95-100	95-100	60-85	25-45	<20	NP-5
	26-60	Loamy fine sand, fine sandy loam.	SM	A-2-4	0-5	95-100	95-100	60-85	15-30	<20	NP
Nb*:											
Nelse-----------	0-18	Loam-------------	SM-SC, SM, CL-ML, ML	A-2-4, A-4	0-5	95-100	95-100	65-90	30-65	<25	NP-5
	18-26	Fine sandy loam, loam, loamy fine sand.	SM, SM-SC	A-2-4, A-4	0-5	95-100	95-100	60-85	25-45	<20	NP-5
	26-60	Loamy fine sand, fine sandy loam.	SM	A-2-4	0-5	95-100	95-100	60-85	15-30	<20	NP
Huntington------	0-13	Silt loam---------	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-95	25-40	5-15
	13-70	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-95	25-40	5-15
	70-84	Stratified fine sand to silty clay loam.	SM, SC, ML, CL	A-2, A-4	0-10	95-100	95-100	50-90	30-75	<30	NP-10
NcE*:											
Nelse-----------	0-18	Loam-------------	SM-SC, SM, CL-ML, ML	A-2-4, A-4	0-5	95-100	95-100	65-90	30-65	<25	NP-5
	18-26	Fine sandy loam, loam, loamy fine sand.	SM, SM-SC	A-2-4, A-4	0-5	95-100	95-100	60-85	25-45	<20	NP-5
	26-60	Loamy fine sand, fine sandy loam.	SM	A-2-4	0-5	95-100	95-100	60-85	15-30	<20	NP

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
NcE*:											
Huntington------	0-13	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-95	25-40	5-15
	13-70	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-95	25-40	5-15
	70-84	Stratified fine sand to silty clay loam.	SM, SC, ML, CL	A-2, A-4	0-10	95-100	95-100	50-90	30-75	<30	NP-10
Wheeling--------	0-9	Silt loam--------	ML, CL, SM, SC	A-4	0	95-100	95-100	85-100	45-90	15-35	NP-10
	9-80	Silty clay loam, loam, gravelly sandy loam.	ML, CL, SM, SC	A-4, A-6	0	95-100	95-100	65-100	45-80	20-40	2-20
	80-96	Stratified very fine sand to sandy loam.	SM, SC	A-2, A-3, A-4	0	95-100	95-100	10-65	5-45	<20	NP-10
Ne--------------- Newark	0-7	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	95-100	80-100	55-95	<32	NP-10
	7-37	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	95-100	95-100	85-100	70-100	22-42	3-20
	37-60	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0-3	95-100	95-100	65-100	55-95	22-42	3-20
NhC-------------- Nicholson	0-7	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	95-100	85-100	80-95	25-35	5-10
	7-18	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4, A-7	0	95-100	95-100	85-100	80-100	25-45	5-20
	18-34	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4, A-7	0	95-100	90-100	80-100	75-100	25-45	5-20
	34-60	Silty clay, clay, channery clay.	CH, CL	A-6, A-7	0-10	80-100	70-100	60-100	55-100	34-70	16-40
NhC3------------- Nicholson	0-6	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	95-100	85-100	80-95	25-35	5-10
	6-13	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4, A-7	0	95-100	95-100	85-100	80-100	25-45	5-20
	13-28	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4, A-7	0	95-100	90-100	80-100	75-100	25-45	5-20
	28-68	Silty clay, clay, channery clay.	CH, CL	A-6, A-7	0-10	80-100	70-100	60-100	55-100	34-70	16-40
NhD-------------- Nicholson	0-7	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	95-100	85-100	80-95	25-35	5-10
	7-18	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4, A-7	0	95-100	95-100	85-100	80-100	25-45	5-20
	18-34	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4, A-7	0	95-100	90-100	80-100	75-100	25-45	5-20
	34-60	Silty clay, clay, channery clay.	CH, CL	A-6, A-7	0-10	80-100	70-100	60-100	55-100	34-70	16-40
NhD3------------- Nicholson	0-6	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	95-100	85-100	80-95	25-35	5-10
	6-13	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4, A-7	0	95-100	95-100	85-100	80-100	25-45	5-20
	13-28	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4, A-7	0	95-100	90-100	80-100	75-100	25-45	5-20
	28-68	Silty clay, clay, channery clay.	CH, CL	A-6, A-7	0-10	80-100	70-100	60-100	55-100	34-70	16-40

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
No---------------- Nolin	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	90-100	80-100	25-40	5-18
	9-40	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	95-100	85-100	75-100	25-46	5-23
	40-72	Loam, silt loam, gravelly loam.	ML, CL, CL-ML, GM	A-4, A-6	0-10	50-100	50-100	40-95	35-95	<30	NP-15
OtB--------------- Otwell	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	25-35	5-15
	8-28	Silty clay loam, silt loam.	CL, CL-ML	A-4, A-6	0	100	100	95-100	70-95	25-40	5-20
	28-51	Silty clay loam, loam, silt loam.	CL	A-6, A-7	0	95-100	95-100	85-100	65-90	35-50	20-30
	51-67	Stratified loam to silty clay.	CL	A-6, A-7	0	95-100	95-100	85-100	65-95	35-50	15-25
OtC3-------------- Otwell	0-3	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	25-35	5-15
	3-15	Silty clay loam, silt loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	25-40	5-20
	15-59	Silty clay loam, loam, silt loam.	CL	A-6, A-7	0	95-100	95-100	85-100	65-90	35-50	20-30
	59-84	Stratified loam to silty clay.	CL	A-6, A-7	0	95-100	95-100	85-100	65-95	35-50	15-25
Pe---------------- Peoga	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	6-56	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	20-30
	56-62	Stratified silty clay loam to silt loam.	CL, ML	A-6, A-7	0	100	100	90-100	70-95	35-50	10-25
Pt*. Pits, quarries											
Pu*: Pits.											
Udorthents.											
SaE--------------- Saffell	0-8	Gravelly silt loam.	SM, ML, SM-SC, CL-ML	A-2, A-4	0-5	75-90	55-75	50-70	25-70	<25	NP-7
	8-15	Gravelly fine sandy loam, gravelly sandy clay loam, gravelly loam.	GC, SC, SM-SC, GM-GC	A-2, A-1, A-4, A-6	0-10	30-75	25-60	20-55	12-50	20-40	3-15
	15-54	Very gravelly sandy clay loam, very gravelly fine sandy loam, very gravelly loam.	GC, SC, SM-SC, GM-GC	A-2, A-1, A-4, A-6	0-10	29-85	21-55	17-50	12-40	20-40	4-15
	54-72	Gravelly sandy loam, very gravelly sandy loam, gravelly loamy sand.	GM, GC, SM, SC	A-1, A-2	0-15	25-80	20-75	10-65	5-35	<30	3-10

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
WfE*:											
Wellston	0-6	Silt loam	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	6-35	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	80-100	75-100	65-95	60-90	25-40	5-20
	35-45	Very channery loam, gravelly sandy loam, channery clay loam.	SM-SC, SC, GM-GC, CL	A-1-b, A-2, A-4, A-6	0-15	60-80	45-75	30-70	15-55	20-35	5-15
	45	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Frondorf	0-8	Silt loam	ML, CL, CL-ML	A-4	0-5	85-100	80-100	80-100	75-100	25-35	5-10
	8-37	Channery silty clay loam, channery silt loam, channery loam.	ML, CL, GM, GC	A-4, A-6, A-2, A-7	10-40	55-90	50-85	40-80	30-75	<45	NP-25
	37	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
WhA, WhB, WhC, WhD Wheeling	0-9	Silt loam	ML, CL, SM, SC	A-4	0	95-100	95-100	85-100	45-90	15-35	NP-10
	9-80	Silty clay loam, loam, gravelly sandy loam.	ML, CL, SM, SC	A-4, A-6	0	95-100	95-100	65-100	45-80	20-40	2-20
	80-96	Stratified very fine sand to sandy loam.	SM, SC	A-2, A-3, A-4	0	95-100	95-100	10-65	4-45	<20	NP-10
ZaC Zanesville	0-5	Silt loam	CL-ML, CL, ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	4-15
	5-25	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	5-20
	25-40	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	80-100	60-100	20-40	2-20
	40-65	Sandy clay loam, clay loam, channery sandy clay loam.	SC, CL, SM, GM	A-6, A-4, A-2, A-1-b	0-10	65-100	50-100	40-100	20-85	20-40	2-20
	65	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
ZaC3 Zanesville	0-5	Silt loam	CL-ML, CL, ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	4-15
	5-18	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	5-20
	18-29	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	80-100	60-100	20-40	2-20
	29-68	Sandy clay loam, clay loam, channery sandy clay loam.	SC, CL, SM, GM	A-6, A-4, A-2, A-1-b	0-10	65-100	50-100	40-100	20-85	20-40	2-20

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
ZaD-------------- Zanesville	0-5	Silt loam--------	CL-ML, CL, ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	4-15
	5-25	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	5-20
	25-40	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	80-100	60-100	20-40	2-20
	40-65	Sandy clay loam, clay loam, channery sandy clay loam.	SC, CL, SM, GM	A-6, A-4, A-2, A-1-b	0-10	65-100	50-100	40-100	20-85	20-40	2-20
	65	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
ZaD3------------- Zanesville	0-5	Silt loam--------	CL-ML, CL, ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	4-15
	5-18	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	5-20
	18-29	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	80-100	60-100	20-40	2-20
	29-68	Sandy clay loam, clay loam, channery sandy clay loam.	SC, CL, SM, GM	A-6, A-4, A-2, A-1-b	0-10	65-100	50-100	40-100	20-85	20-40	2-20

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH				Pct
AsA------------- Ashton	0-10	10-27	1.20-1.40	0.6-2.0	0.16-0.23	5.6-7.3	Low----------	0.32	5	2-4
	10-60	18-34	1.20-1.50	0.6-2.0	0.18-0.23	5.6-7.3	Low----------	0.43		
BaE------------- Baxter	0-8	12-27	1.20-1.40	0.6-2.0	0.14-0.18	4.5-6.5	Low----------	0.28	5	2-4
	8-27	18-40	1.30-1.55	0.6-2.0	0.14-0.18	4.5-6.5	Moderate-----	0.24		
	27-64	35-60	1.30-1.55	0.6-2.0	0.10-0.14	4.5-5.5	Moderate-----	0.24		
BrC------------- Brandon	0-6	12-27	1.20-1.40	0.6-2.0	0.18-0.23	4.5-5.5	Low----------	0.37	3	2-4
	6-34	18-35	1.20-1.45	0.6-2.0	0.18-0.23	4.5-5.5	Low----------	0.28		
	34-60	15-35	1.20-1.45	2.0-20.0	0.05-0.12	4.5-5.5	Low----------	0.17		
BrC3------------ Brandon	0-5	12-27	1.20-1.40	0.6-2.0	0.18-0.23	4.5-5.5	Low----------	0.37	3	.5-2
	5-36	18-35	1.20-1.45	0.6-2.0	0.18-0.23	4.5-5.5	Low----------	0.28		
	36-60	15-35	1.20-1.45	2.0-20.0	0.05-0.12	4.5-5.5	Low----------	0.17		
BrD------------- Brandon	0-6	12-27	1.20-1.40	0.6-2.0	0.18-0.23	4.5-5.5	Low----------	0.37	3	2-4
	6-34	18-35	1.20-1.45	0.6-2.0	0.18-0.23	4.5-5.5	Low----------	0.28		
	34-60	15-35	1.20-1.45	2.0-20.0	0.05-0.12	4.5-5.5	Low----------	0.17		
BrD3------------ Brandon	0-5	12-27	1.20-1.40	0.6-2.0	0.18-0.23	4.5-5.5	Low----------	0.37	3	.5-2
	5-36	18-35	1.20-1.45	0.6-2.0	0.18-0.23	4.5-5.5	Low----------	0.28		
	36-60	15-35	1.20-1.45	2.0-20.0	0.05-0.12	4.5-5.5	Low----------	0.17		
ChB, ChD-------- Chavies	0-14	7-18	1.20-1.40	2.0-6.0	0.11-0.18	4.5-7.3	Low----------	0.24	4	2-4
	14-60	7-18	1.20-1.40	2.0-6.0	0.11-0.20	4.5-7.3	Low----------	0.24		
Du-------------- Dunning	0-7	40-50	1.20-1.40	0.6-2.0	0.19-0.23	5.6-7.8	Moderate-----	0.32	5	4-10
	7-62	40-60	1.40-1.65	0.06-0.2	0.14-0.18	5.6-7.8	Moderate-----	0.28		
EkA, EkB, EkC---- Elk	0-9	10-27	1.20-1.40	0.6-2.0	0.19-0.23	4.5-6.5	Low----------	0.37	5	2-3
	9-76	18-34	1.20-1.50	0.6-2.0	0.18-0.22	4.5-6.5	Low----------	0.28		
	76-96	15-27	1.20-1.50	0.6-2.0	0.14-0.20	4.5-6.5	Low----------	0.28		
FrD------------- Frondorf	0-8	18-27	1.20-1.40	0.6-2.0	0.18-0.22	4.5-5.5	Low----------	0.37	3	1-3
	8-37	18-35	1.20-1.45	0.6-2.0	0.08-0.16	4.5-5.5	Low----------	0.17		
	37	---	---	---	---	---	-------------	----		
FrD3------------ Frondorf	0-2	18-27	1.20-1.40	0.6-2.0	0.18-0.22	4.5-5.5	Low----------	0.37	3	1-2
	2-27	18-35	1.20-1.45	0.6-2.0	0.08-0.16	4.5-5.5	Low----------	0.17		
	27	---	---	---	---	---	-------------	----		
FrE------------- Frondorf	0-8	18-27	1.20-1.40	0.6-2.0	0.18-0.22	4.5-5.5	Low----------	0.37	3	1-3
	8-37	18-35	1.20-1.45	0.6-2.0	0.08-0.16	4.5-5.5	Low----------	0.17		
	37	---	---	---	---	---	-------------	----		
HaC------------- Hammack	0-7	12-27	1.20-1.40	0.6-2.0	0.19-0.23	4.5-7.3	Low----------	0.37	4	2-4
	7-28	18-35	1.20-1.45	0.6-2.0	0.18-0.23	4.5-6.5	Low----------	0.32		
	28-40	18-35	1.20-1.45	0.6-2.0	0.05-0.10	4.5-6.0	Low----------	0.24		
	40-76	35-60	1.35-1.65	0.6-2.0	0.08-0.12	4.5-6.0	Moderate-----	0.24		
HaC3------------ Hammack	0-6	12-27	1.20-1.40	0.6-2.0	0.19-0.23	4.5-7.3	Low----------	0.37	4	.5-2
	6-13	18-35	1.20-1.45	0.6-2.0	0.18-0.23	4.5-6.5	Low----------	0.32		
	13-22	18-35	1.20-1.45	0.6-2.0	0.05-0.10	4.5-6.0	Low----------	0.24		
	22-60	35-60	1.35-1.65	0.6-2.0	0.08-0.12	4.5-6.0	Moderate-----	0.24		

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH				Pct
HaD	0-7	12-27	1.20-1.40	0.6-2.0	0.19-0.23	4.5-7.3	Low	0.37	4	2-4
Hammack	7-28	18-35	1.20-1.45	0.6-2.0	0.18-0.23	5.1-6.5	Low	0.32		
	28-40	18-35	1.20-1.45	0.6-2.0	0.05-0.10	4.5-6.0	Low	0.24		
	40-76	35-60	1.35-1.65	0.6-2.0	0.08-0.12	4.5-6.0	Moderate	0.24		
HaD3	0-6	12-27	1.20-1.40	0.6-2.0	0.19-0.23	4.5-7.3	Low	0.37	4	.5-2
Hammack	6-13	18-35	1.20-1.45	0.6-2.0	0.18-0.23	4.5-6.5	Low	0.32		
	13-22	18-35	1.20-1.45	0.6-2.0	0.05-0.10	4.5-6.0	Low	0.24		
	22-60	35-60	1.35-1.65	0.6-2.0	0.08-0.12	4.5-6.0	Moderate	0.24		
Hn	0-6	12-27	1.20-1.40	0.6-2.0	0.18-0.23	5.6-7.3	Low	0.43	4	.5-2
Henshaw	6-63	18-34	1.20-1.40	0.2-0.6	0.15-0.19	5.1-8.4	Low	0.43		
Hu	0-13	18-27	1.10-1.30	0.6-2.0	0.18-0.24	5.6-7.8	Low	0.28	5	4-6
Huntington	13-70	18-30	1.30-1.50	0.6-2.0	0.16-0.22	5.6-7.8	Low	0.32		
	70-84	10-30	1.30-1.50	0.6-2.0	0.10-0.16	5.6-7.8	Low	0.28		
Ka	0-4	40-60	1.20-1.40	0.06-0.2	0.11-0.14	5.6-7.3	High	0.32	5	2-3
Karnak	4-62	40-60	1.30-1.50	<0.2	0.09-0.13	5.6-7.3	High	0.32		
LcB	0-6	15-27	1.35-1.50	0.6-2.0	0.21-0.24	4.5-6.0	Low	0.43	3	2-3
Licking	6-12	24-35	1.40-1.60	0.2-0.6	0.18-0.22	4.5-6.0	Moderate	0.43		
	12-60	40-60	1.45-1.65	0.06-0.2	0.10-0.14	5.1-7.3	High	0.32		
	60-75	24-60	1.55-1.75	0.06-0.2	0.06-0.10	5.6-7.8	High	0.32		
LkC3	0-3	27-35	1.36-1.55	0.2-0.6	0.20-0.23	4.5-6.0	Moderate	0.43	3	.5-2
Licking	3-36	35-60	1.45-1.65	0.06-0.2	0.10-0.14	5.1-7.3	High	0.32		
	36-63	24-60	1.55-1.75	0.06-0.2	0.06-0.10	5.6-7.8	High	0.32		
Ln	0-5	15-27	1.20-1.40	0.6-2.0	0.20-0.26	5.1-7.8	Low	0.32	5	2-4
Lindside	5-34	18-35	1.20-1.40	0.6-2.0	0.17-0.22	5.1-7.8	Low	0.37		
	34-85	18-35	1.20-1.40	0.6-6.0	0.12-0.18	5.6-7.8	Low	0.32		
LoB, LoC	0-9	8-18	1.30-1.50	0.6-2.0	0.20-0.23	4.5-6.0	Low	0.49	3	.5-2
Loring	9-26	18-32	1.40-1.50	0.6-2.0	0.20-0.22	4.5-6.0	Low	0.43		
	26-55	15-30	1.50-1.70	0.2-0.6	0.06-0.13	4.5-6.0	Low	0.43		
	55-65	10-25	1.30-1.60	0.2-2.0	0.06-0.13	4.5-6.5	Low	0.43		
LoC3	0-6	8-18	1.30-1.50	0.6-2.0	0.20-0.23	4.5-6.0	Low	0.49	3	.5-2
Loring	6-14	18-32	1.40-1.50	0.6-2.0	0.20-0.22	4.5-6.0	Low	0.43		
	14-70	15-30	1.50-1.70	0.2-0.6	0.06-0.13	4.5-6.0	Low	0.43		
LoD	0-9	8-18	1.30-1.50	0.6-2.0	0.20-0.23	4.5-6.0	Low	0.49	3	.5-2
Loring	9-26	18-32	1.40-1.50	0.6-2.0	0.20-0.22	4.5-6.0	Low	0.43		
	26-55	15-30	1.50-1.70	0.2-0.6	0.06-0.13	4.5-6.0	Low	0.43		
	55-65	10-25	1.30-1.60	0.2-2.0	0.06-0.13	4.5-6.5	Low	0.43		
LoD3	0-6	8-18	1.30-1.50	0.6-2.0	0.20-0.23	4.5-6.0	Low	0.49	3	.5-2
Loring	6-14	18-32	1.40-1.50	0.6-2.0	0.20-0.22	4.5-6.0	Low	0.43		
	14-70	15-30	1.50-1.70	0.2-0.6	0.06-0.13	4.5-6.0	Low	0.43		
LwD*, LwE*:										
Lowell	0-4	12-27	1.20-1.40	0.6-2.0	0.18-0.23	4.5-6.5	Low	0.37	3	2-4
	4-23	35-60	1.30-1.60	0.2-2.0	0.13-0.19	4.5-6.5	Moderate	0.28		
	23-44	40-60	1.50-1.60	0.2-0.6	0.12-0.17	5.1-7.8	Moderate	0.28		
	44	---	---	---	---	---	-------------	----		
Faywood	0-5	27-40	1.30-1.40	0.6-2.0	0.18-0.22	5.1-7.8	Low	0.37	3	2-4
	5-36	40-60	1.35-1.45	0.06-0.6	0.12-0.17	5.1-7.8	Moderate	0.28		
	36	---	---	---	---	---	-------------	----		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH				Pct
Mc---------------- McGary	0-7	22-27	1.35-1.50	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.43	3	2-4
	7-72	35-60	1.60-1.70	0.06-0.2	0.11-0.13	5.6-8.4	High---------	0.32		
Me---------------- Melvin	0-9	12-17	1.20-1.60	0.6-2.0	0.18-0.23	5.6-7.8	Low----------	0.43	5	2-3
	9-30	12-35	1.30-1.60	0.6-2.0	0.18-0.23	5.6-7.8	Low----------	0.43		
	30-62	7-35	1.40-1.70	0.6-2.0	0.16-0.23	5.6-7.8	Low----------	0.43		
MmB, MmC--------- Memphis	0-7	8-22	1.30-1.50	0.6-2.0	0.20-0.23	4.5-6.0	Low----------	0.49	5	2-4
	7-88	12-32	1.30-1.50	0.6-2.0	0.20-0.23	4.5-6.0	Low----------	0.49		
MmC3------------- Memphis	0-2	8-22	1.30-1.50	0.6-2.0	0.20-0.23	4.5-6.0	Low----------	0.49	5	1-2
	2-84	12-32	1.30-1.50	0.6-2.0	0.20-0.23	4.5-6.0	Low----------	0.49		
MmD-------------- Memphis	0-7	8-22	1.30-1.50	0.6-2.0	0.20-0.23	4.5-6.0	Low----------	0.49	5	2-4
	7-88	12-32	1.30-1.50	0.6-2.0	0.20-0.23	4.5-6.0	Low----------	0.49		
MmD3------------- Memphis	0-2	8-22	1.30-1.50	0.6-2.0	0.20-0.23	4.5-6.0	Low----------	0.49	5	1-2
	2-84	12-32	1.30-1.50	0.6-2.0	0.20-0.23	4.5-6.0	Low----------	0.49		
Na---------------- Nelse	0-18	5-25	1.20-1.60	2.0-6.0	0.09-0.14	6.1-8.4	Low----------	0.17	5	4-10
	18-26	2-18	1.40-1.80	2.0-20	0.09-0.14	6.1-8.4	Low----------	0.15		
	26-60	2-12	1.40-1.80	2.0-20	0.05-0.10	6.1-8.4	Low----------	0.15		
Nb*:										
Nelse-----------	0-18	5-25	1.20-1.60	2.0-6.0	0.09-0.14	6.1-8.4	Low----------	0.17	5	4-10
	18-26	2-18	1.40-1.80	2.0-20	0.09-0.14	6.1-8.4	Low----------	0.15		
	26-60	2-12	1.40-1.80	2.0-20	0.05-0.10	6.1-8.4	Low----------	0.15		
Huntington------	0-13	18-27	1.10-1.30	0.6-2.0	0.18-0.24	5.6-7.8	Low----------	0.28	5	4-6
	13-70	18-30	1.30-1.50	0.6-2.0	0.16-0.22	5.6-7.8	Low----------	0.32		
	70-84	10-30	1.30-1.50	0.6-2.0	0.10-0.16	5.6-7.8	Low----------	0.28		
NcE*:										
Nelse-----------	0-18	5-25	1.20-1.60	2.0-6.0	0.09-0.14	6.1-8.4	Low----------	0.17	5	4-10
	18-26	2-18	1.40-1.80	2.0-20	0.09-0.14	6.1-8.4	Low----------	0.15		
	26-60	2-12	1.40-1.80	2.0-20	0.05-0.10	6.1-8.4	Low----------	0.15		
Huntington------	0-13	18-27	1.10-1.30	0.6-2.0	0.18-0.24	5.6-7.8	Low----------	0.28	5	4-6
	13-70	18-30	1.30-1.50	0.6-2.0	0.16-0.22	5.6-7.8	Low----------	0.32		
	70-84	10-30	1.30-1.50	0.6-2.0	0.10-0.16	5.6-7.8	Low----------	0.28		
Wheeling--------	0-9	12-20	1.20-1.40	0.6-6.0	0.12-0.18	5.1-6.0	Low----------	0.37	4	2-3
	9-80	18-30	1.30-1.50	0.6-2.0	0.08-0.16	5.1-6.0	Low----------	0.32		
	80-96	8-15	1.30-1.50	6.0-20	0.04-0.08	5.1-6.0	Low----------	0.20		
Ne---------------- Newark	0-7	7-27	1.20-1.40	0.6-2.0	0.15-0.23	5.6-7.8	Low----------	0.43	5	2-4
	7-37	18-35	1.20-1.45	0.6-2.0	0.18-0.23	5.6-7.8	Low----------	0.43		
	37-60	12-50	1.30-1.50	0.6-2.0	0.15-0.22	5.6-7.8	Low----------	0.43		
NhC--------------- Nicholson	0-7	12-27	1.20-1.40	0.6-2.0	0.19-0.23	4.5-6.5	Low----------	0.43	3	2-4
	7-18	18-35	1.40-1.60	0.6-2.0	0.18-0.22	4.5-6.5	Low----------	0.43		
	18-34	18-35	1.50-1.70	0.06-0.2	0.07-0.12	4.5-6.5	Low----------	0.43		
	34-60	35-60	1.40-1.60	0.06-0.6	0.07-0.12	5.1-7.8	Moderate-----	0.37		
NhC3------------- Nicholson	0-6	12-27	1.20-1.40	0.6-2.0	0.19-0.23	4.5-6.5	Low----------	0.43	3	.5-2
	6-13	18-35	1.40-1.60	0.6-2.0	0.18-0.22	4.5-6.5	Low----------	0.43		
	13-28	18-35	1.50-1.70	0.06-0.2	0.07-0.12	4.5-6.5	Low----------	0.43		
	28-68	35-60	1.40-1.60	0.06-0.6	0.07-0.12	5.1-7.8	Moderate-----	0.37		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH				Pct
NhD--------------	0-7	12-27	1.20-1.40	0.6-2.0	0.19-0.23	4.5-6.5	Low-----------	0.43	3	2-4
Nicholson	7-18	18-35	1.40-1.60	0.6-2.0	0.18-0.22	4.5-6.5	Low-----------	0.43		
	18-34	18-35	1.50-1.70	0.06-0.2	0.07-0.12	4.5-6.5	Low-----------	0.43		
	34-60	35-60	1.40-1.60	0.06-0.6	0.07-0.12	5.1-7.8	Moderate------	0.37		
NhD3-------------	0-6	12-27	1.20-1.40	0.6-2.0	0.19-0.23	4.5-6.5	Low-----------	0.43	3	.5-2
Nicholson	6-13	18-35	1.40-1.60	0.6-2.0	0.18-0.22	4.5-6.5	Low-----------	0.43		
	13-28	18-35	1.50-1.70	0.06-0.2	0.07-0.12	4.5-6.5	Low-----------	0.43		
	28-68	35-60	1.40-1.60	0.06-0.6	0.07-0.12	5.1-7.8	Moderate------	0.37		
No---------------	0-9	12-27	1.20-1.40	0.6-2.0	0.18-0.23	5.6-8.4	Low-----------	0.43	5	2-4
Nolin	9-40	18-35	1.25-1.50	0.6-2.0	0.18-0.23	5.6-8.4	Low-----------	0.43		
	40-72	10-30	1.30-1.55	0.6-6.0	0.10-0.23	5.1-8.4	Low-----------	0.43		
OtB--------------	0-8	18-27	1.25-1.40	0.6-2.0	0.22-0.24	4.5-7.3	Low-----------	0.43	3	.5-2
Otwell	8-28	22-35	1.30-1.45	0.2-0.6	0.18-0.22	4.5-5.5	Low-----------	0.43		
	28-51	18-30	1.60-1.80	<0.06	0.06-0.08	4.5-5.5	Low-----------	0.43		
	51-67	20-30	1.55-1.65	0.06-0.2	0.19-0.21	5.1-8.4	Low-----------	0.43		
OtC3-------------	0-3	18-27	1.25-1.40	0.6-2.0	0.22-0.24	4.5-7.3	Low-----------	0.43	3	.5-2
Otwell	3-15	22-35	1.30-1.45	0.2-0.6	0.18-0.22	4.5-5.5	Low-----------	0.43		
	15-59	18-30	1.60-1.80	<0.06	0.06-0.08	4.5-5.5	Low-----------	0.43		
	59-84	20-30	1.55-1.65	0.06-0.2	0.19-0.21	5.1-8.4	Low-----------	0.43		
Pe---------------	0-6	15-27	1.30-1.45	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.43	5	1-2
Peoga	6-56	22-34	1.40-1.60	0.06-0.2	0.18-0.20	4.5-6.0	Low-----------	0.43		
	56-62	20-34	1.40-1.60	0.06-0.2	0.19-0.21	4.5-6.5	Low-----------	0.43		
Pt*.										
Pits, quarries										
Pu*:										
Pits.										
Udorthents.										
SaE--------------	0-8	5-25	1.30-1.60	2.0-6.0	0.08-0.20	4.5-5.5	Low-----------	0.24	4	1-2
Saffell	8-15	10-35	1.35-1.60	0.06-2.0	0.06-0.15	4.5-5.5	Low-----------	0.28		
	15-54	12-35	1.35-1.60	0.6-2.0	0.06-0.12	4.5-5.5	Low-----------	0.28		
	54-72	10-25	1.30-1.65	0.6-6.0	0.04-0.11	4.5-5.5	Low-----------	0.17		
WfE*:										
Wellston---------	0-6	13-27	1.30-1.50	0.6-2.0	0.18-0.22	4.5-6.5	Low-----------	0.37	4	2-3
	6-35	18-35	1.30-1.65	0.6-2.0	0.17-0.21	4.5-6.0	Low-----------	0.37		
	35-45	15-30	1.30-1.60	0.6-2.0	0.06-0.16	4.5-6.0	Low-----------	0.20		
	45	---	---	---	---	---	--------------	----		
Frondorf---------	0-8	18-27	1.20-1.40	0.6-2.0	0.18-0.22	4.5-5.5	Low-----------	0.37	3	2-3
	8-37	18-35	1.20-1.45	0.6-2.0	0.08-0.16	4.5-5.5	Low-----------	0.17		
	37	---	---	---	---	---	--------------	----		
WhA, WhB, WhC,										
WhD--------------	0-9	12-20	1.20-1.40	0.6-6.0	0.12-0.18	5.1-6.5	Low-----------	0.37	4	2-3
Wheeling	9-80	18-30	1.30-1.50	0.6-2.0	0.08-0.16	5.1-6.0	Low-----------	0.32		
	80-96	8-30	1.30-1.50	6.0-20	0.04-0.08	5.1-6.0	Low-----------	0.20		
ZaC--------------	0-5	12-27	1.35-1.40	0.6-2.0	0.19-0.23	4.5-6.0	Low-----------	0.43	3	1-2
Zanesville	5-25	18-35	1.35-1.45	0.6-2.0	0.17-0.22	4.5-6.0	Low-----------	0.37		
	25-40	18-33	1.50-1.75	0.06-0.2	0.08-0.12	4.5-6.0	Low-----------	0.37		
	40-65	20-40	1.50-1.70	0.2-2.0	0.08-0.12	4.5-6.0	Low-----------	0.28		
	65	---	---	---	---	---	--------------	----		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH				Pct
ZaC3-------------	0-5	12-27	1.35-1.40	0.6-2.0	0.19-0.23	4.5-6.0	Low----------	0.43	3	1-2
Zanesville	5-18	18-35	1.35-1.45	0.6-2.0	0.17-0.22	4.5-6.0	Low----------	0.37		
	18-29	18-33	1.50-1.75	0.06-0.2	0.08-0.12	4.5-6.0	Low----------	0.37		
	29-68	20-40	1.50-1.70	0.2-2.0	0.08-0.12	4.5-6.0	Low----------	0.28		
ZaD--------------	0-5	12-27	1.35-1.40	0.6-2.0	0.19-0.23	4.5-6.0	Low----------	0.43	3	1-2
Zanesville	5-25	18-35	1.35-1.45	0.6-2.0	0.17-0.22	4.5-6.0	Low----------	0.37		
	25-40	18-33	1.50-1.75	0.06-0.2	0.08-0.12	4.5-6.0	Low----------	0.37		
	40-65	20-40	1.50-1.70	0.2-2.0	0.08-0.12	4.5-6.0	Low----------	0.28		
	65	---	---	---	---	---	-------------	----		
ZaD3-------------	0-5	12-27	1.35-1.40	0.6-2.0	0.19-0.23	4.5-6.0	Low----------	0.43	3	1-2
Zanesville	5-18	18-35	1.35-1.45	0.6-2.0	0.17-0.22	4.5-6.0	Low----------	0.37		
	18-29	18-33	1.50-1.75	0.06-0.2	0.08-0.12	4.5-6.0	Low----------	0.37		
	29-68	20-40	1.50-1.70	0.2-2.0	0.08-0.12	4.5-6.0	Low----------	0.28		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
AsA---------------Ashton	B	Occasional	Very brief	Jan-Apr	>6.0	---	---	>60	---	Low------	Low.
BaE---------------Baxter	B	None--------	---	---	>6.0	---	---	>60	---	High-----	High.
BrC, BrC3, BrD, BrD3------------Brandon	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High.
ChB, ChD----------Chavies	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate.
Du----------------Dunning	D	Frequent----	Brief-----	Dec-May	0-0.5	Apparent	Jan-Apr	>60	---	High-----	Moderate.
EkA, EkB, EkC-----Elk	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
FrD, FrD3, FrE----Frondorf	B	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	High.
HaC, HaC3, HaD, HaD3------------Hammack	B	None--------	---	---	>6.0	---	---	>72	---	Moderate	Moderate.
Hn----------------Henshaw	C	Rare--------	---	---	1.0-2.0	Apparent	Nov-Mar	>60	---	High-----	Moderate.
Hu----------------Huntington	B	Frequent----	Brief-----	Dec-May	>6.0	---	---	>60	---	Low------	Moderate.
Ka----------------Karnak	D	Frequent----	Brief-----	Mar-May	0-3.0	Apparent	Apr-Jun	>60	---	High-----	Moderate.
LcB, LkC3---------Licking	C	None--------	---	---	2.0-3.5	Apparent	Jan-Apr	>60	---	High-----	High.
Ln----------------Lindside	C	Frequent----	Very brief to brief.	Dec-Apr	1.5-3.0	Apparent	Dec-Apr	>60	---	Moderate	Low.
LoB, LoC, LoC3, LoD, LoD3--------Loring	C	None--------	---	---	2.0-3.0	Perched	Dec-Mar	>60	---	Moderate	Moderate.
LwD*, LwE*:											
Lowell-----------	C	None--------	---	---	>6.0	---	---	>40	Hard	High-----	Moderate.
Faywood----------	C	None--------	---	---	>6.0	---	---	20-40	Hard	High-----	Moderate.
Mc----------------McGary	C	Rare--------	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High-----	Low.
Me----------------Melvin	D	Frequent----	Brief-----	Dec-May	0-1.0	Apparent	Dec-May	>60	---	High-----	Low.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In			
MmB, MmC, MmC3, MmD, MmD3 Memphis	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
Na Nelse	B	Frequent	Brief	Jan-Dec	>6.0	Apparent	Feb-Mar	>60	---	Low	Moderate.
Nb*:											
Nelse	B	Frequent	Brief	Jan-Dec	>6.0	Apparent	Feb-Mar	>60	---	Low	Moderate.
Huntington	B	Frequent	Brief	Dec-May	>6.0	---	---	>60	---	Low	Moderate.
NcE*:											
Nelse	B	Frequent	Brief to long.	Jan-Dec	>6.0	Apparent	Feb-Mar	>60	---	Low	Moderate.
Huntington	B	Frequent	Brief to long.	Dec-May	>6.0	---	---	>60	---	Low	Moderate.
Wheeling	B	Rare	---	---	>6.0	---	---	>60	---	Low	Moderate.
Ne Newark	C	Frequent	Brief	Jan-Apr	0.5-1.5	Apparent	Dec-May	>60	---	High	Low.
NhC, NhC3, NhD, NhD3 Nicholson	C	None	---	---	1.5-2.5	Perched	Jan-Apr	>60	---	High	Moderate.
No Nolin	B	Frequent	Brief	Jan-Apr	3.0-6.0	Apparent	Feb-Mar	>60	---	Low	Moderate.
OtB, OtC3 Otwell	C	None	---	---	1.5-2.5	Perched	Jan-Apr	>60	---	Moderate	High.
Pe Peoga	C	None	---	---	0-1.0	Apparent	Jan-May	>60	---	High	High.
Pt*. Pits, quarries											
Pu*: Pits.											
Udorthents.											
SaE Saffell	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate.
WfE*:											
Wellston	B	None	---	---	>6.0	---	---	40-72	Hard	Moderate	High.
Frondorf	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	High.
WhA, WhB, WhC, WhD Wheeling	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
ZaC, ZaC3, ZaD, ZaD3------------- Zanesville	C	None--------	---	---	2.0-3.0	Perched	Dec-Apr	40-80	Hard	Moderate	High.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL ANALYSES OF SELECTED SOILS

(A dash indicates that the material was not detected. A blank indicates that a determination was not made. The pedons for the soils listed are typical of the series in the survey area. For the location of the pedons, see the section "Soil Series and Their Morphology." Analyses by the Kentucky Agricultural Experiment Station)

Soil name, report number, horizon, and depth in inches	Total: Sand (2-0.05 mm)	Total: Silt (0.05-0.002 mm)	Total: Clay (<0.002 mm)	Sand: Very coarse (2-1)	Sand: Coarse (1-0.5)	Sand: Medium (0.5-0.25)	Sand: Fine (0.25-0.1)	Sand: Very fine (0.1-0.05)	Sand coarser than very fine (2-0.1)	Very fine sand plus silt (0.1-0.002)	Textural class	Coarse fragments: >2 mm	Coarse fragments: 2-19 mm	Coarse fragments: 19-76 mm
	Pct <2 mm											Pct	Pct	Pct
McGary silt loam:														
86KY-139-9-(1-6)														
Ap-------- 0-7	8.5	67.9	23.6	1.7	1.9	0.8	1.1	3.0	5.5	70.9	sil			
Bt1------- 7-13	2.5	49.8	47.7	0.1	0.4	0.2	0.5	1.3	1.2	51.1	sic			
Bt2-------13-25	2.0	47.0	51.0	0.1	0.2	0.1	0.4	1.2	0.8	48.2	sic			
Bt3-------25-37	2.6	51.2	46.2	0.2	0.5	0.3	0.6	1.0	1.6	52.2	sic			
CB--------37-57	3.5	55.5	41.0	---	0.3	0.5	1.2	1.5	2.0	57.0	sic			
Ck--------57-72	1.5	55.5	43.0	---	---	0.1	0.3	1.1	0.4	56.6	sic			
Memphis silt loam:														
86KY-139-8-(1-9)														
Ap-------- 0-7	7.4	78.0	14.6	0.3	0.7	0.7	1.6	4.1	3.3	82.1	sil			
BA-------- 7-12	2.7	70.5	26.8	---	0.2	0.2	0.5	1.8	0.9	72.3	sil			
Bt1-------12-20	2.0	73.0	25.0	---	0.1	0.1	0.3	1.5	0.5	74.5	sil			
Bt2-------20-30	6.8	68.9	24.3	0.1	0.2	0.2	0.4	5.9	0.9	74.8	sil			
Bt3-------30-44	2.0	76.2	21.8	---	---	0.1	0.2	1.7	0.3	77.9	sil			
Bt4-------44-60	1.6	79.5	18.9	0.2	0.1	0.1	0.2	1.0	0.6	80.5	sil			
BC--------60-69	2.4	78.6	19.0	---	0.1	0.1	0.3	1.9	0.5	80.5	sil			
C1--------69-78	3.1	76.2	20.7	---	0.1	0.1	0.5	2.4	0.7	78.6	sil			
C2--------78-88	3.8	72.7	23.5	0.2	0.2	0.3	0.8	2.3	1.5	75.0	sil			
Saffell gravelly silt loam:														
86KY-139-7-(1-6)														
Ap-------- 0-8	21.4	67.3	11.3	3.6	3.3	3.8	4.4	6.3	15.1	73.6	sil	55.4	34.8	20.6
BA-------- 8-15	20.6	66.2	13.2	7.2	2.9	3.5	4.1	2.9	17.7	69.1	sil	82.8	47.6	35.2
Bt1-------15-30	35.1	35.1	29.8	11.1	8.0	6.1	5.9	4.0	31.1	39.1	cl	86.7	49.0	37.7
Bt2-------30-44	47.8	20.0	32.2	13.3	9.9	8.6	9.0	7.0	40.8	27.0	scl	87.1	37.7	49.4
BC--------44-54	49.3	26.9	23.8	18.1	8.2	6.2	8.6	8.2	41.1	35.1	scl	86.5	42.5	44.0
C---------54-72	65.3	18.8	15.9	34.6	12.1	8.9	7.1	2.6	62.7	21.4	sl	83.9	61.8	22.1

TABLE 18.--CHEMICAL ANALYSES OF SELECTED SOILS

(A dash indicates that the material was not detected. A blank indicates that a determination was not made. The pedons for the soils listed are typical of the series in the survey area. For the location of the pedons, see the section "Soil Series and Their Morphology." Analyses by the Kentucky Agricultural Experiment Station)

Soil name, report number, horizon, and depth in inches	pH (H_2O 1:1)	Extractable cations: Ca	Mg	K	Na	Total (TEC)	Cation-exchange capacity: Ammonium acetate	Sum of cations	Extractable acidity	Base saturation: Ammonium acetate	Sum of cations	Organic matter	Calcium carbonate equivalent	Phosphorus	Potassium
		-----Milliequivalents per 100 grams of soil-----								Pct	Pct	Pct	Pct	p/m	p/m
McGary silt loam:															
86KY-139-9-(1-6)															
Ap----- 0 to 7	6.1	4.1	1.3	0.6	0.2	6.2	8.5	13.9	7.7	73	45	2.1	---	18	167
Bt1---- 7 to 13	5.6	3.4	2.8	0.8	0.3	7.3	6.9	12.5	5.2	106	59	0.6	---	3	217
Bt2---- 13 to 25	5.6	3.0	3.9	0.9	0.5	8.2	8.5	17.2	9.0	97	48	0.5	---	8	209
Bt3---- 25 to 37	5.8	4.0	6.1	0.8	0.8	11.7	9.2	17.0	5.3	127	69	0.4	---	8	215
CB----- 37 to 57	6.7	3.8	5.7	0.5	1.1	11.1	10.9	13.7	2.6	102	81	0.4	---	10	127
Ck----- 57 to 72	7.9	4.4	6.2	0.6	1.1	12.3	12.0	12.3	0.0	103	100	0.4	12.5	11	126
Memphis silt loam:															
86KY-139-8-(1-9)															
Ap----- 0 to 7	6.2	4.1	0.8	1.0	0.1	6.0	10.4	8.9	3.9	58	67	2.8		42	349
BA----- 7 to 12	6.4	3.1	1.2	1.0	0.2	5.5	11.3	12.6	7.1	49	44	1.0		10	316
Bt1---- 12 to 20	5.1	2.6	1.2	0.9	0.1	4.8	12.3	13.1	8.3	39	37	1.0		7	208
Bt2---- 20 to 30	5.0	1.6	1.0	0.7	0.2	3.5	10.7	17.6	14.1	33	20	0.2		9	163
Bt3---- 30 to 44	5.3	1.3	1.0	0.6	2.0	4.9	10.3	14.1	9.2	48	35	0.2		14	161
Bt4---- 44 to 60	5.1	1.4	1.0	0.6	0.2	3.2	9.4	13.0	9.8	34	25	0.3		22	142
BC----- 60 to 69	5.5	2.2	1.3	0.5	0.2	4.2	9.4	9.5	5.3	45	44	0.4		33	159
C1----- 69 to 78	5.4	2.5	0.7	0.3	0.2	3.7	10.1	9.4	5.7	37	39	0.3		66	111
C2----- 78 to 88	5.5	2.9	1.5	0.5	0.2	5.1	10.1	9.2	4.1	50	55	0.3		43	111
Saffell gravelly silt loam:															
86KY-139-7-(1-6)															
Ap----- 0 to 8	6.2	3.6	0.1	0.7	0.2	4.6	5.3	8.4	3.8	87	55	2.1		11	266
BA----- 8 to 15	6.4	2.3	0.1	0.3	0.1	2.8	4.0	7.3	4.5	70	38	0.9		13	124
Bt1---- 15 to 30	4.9	0.8	0.7	0.5	0.1	2.1	10.3	12.4	15.6	20	17	0.3		3	163
Bt2---- 30 to 44	4.9	0.5	0.7	0.4	0.1	1.7	7.4	11.7	10.0	23	15	0.2		4	152
BC----- 44 to 54	4.9	0.4	0.3	0.2	0.1	1.0	5.1	9.7	8.7	20	10	0.1		5	91
C------ 54 to 72	5.0	0.5	0.7	0.4	0.1	1.7	6.8	11.0	9.3	25	15	0.1		7	163

TABLE 19.--ENGINEERING INDEX TEST DATA

(A dash indicates that data were not available. The pedons for the soils listed are typical of the series in the survey area. For the location of the pedons, see the section "Soil Series and Their Morphology." Analyses by the Soil Mechanics Laboratory, Soil Conservation Service, Fort Worth, Texas)

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution							Liquid limit	Plasticity index	Moisture density		Specific gravity
			Percentage passing sieve--				Percentage smaller than--					Maximum dry density	Optimum moisture	
	AASHTO	Unified	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm	Pct		Lb/cu ft	Pct	
McGary silt loam: (86KY-139-9)														
Bt1 & Bt2- 7 to 25	---	CH	---	---	---	100	89	63	49	62	37	97.0	25.5	2.68
Bt3-------25 to 37	---	CH	---	---	---	100	90	63	45	51	31	104.5	19.5	2.70
CB--------37 to 57	---	CL	---	100	---	91	87	50	35	42	21	105.0	20.0	2.75
Memphis silt loam: (86KY-139-8)														
Bt1 & Bt2-12 to 30	---	CL	---	---	---	100	63	40	18	35	11	105.0	18.5	2.75
Bt3 & Bt4-30 to 60	---	CL	---	100	---	97	64	27	22	42	19	102.0	19.0	2.72

TABLE 20.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
*Ashton	Fine-silty, mixed, mesic Mollic Hapludalfs
Baxter	Fine, mixed, mesic Typic Paleudalfs
Brandon	Fine-silty, mixed, thermic Typic Hapludults
Chavies	Coarse-loamy, mixed, mesic Ultic Hapludalfs
Dunning	Fine, mixed, mesic Fluvaquentic Haplaquolls
Elk	Fine-silty, mixed, mesic Ultic Hapludalfs
Faywood	Fine, mixed, mesic Typic Hapludalfs
Frondorf	Fine-loamy, mixed, mesic Ultic Hapludalfs
Hammack	Fine-silty, mixed, mesic Glossic Paleudalfs
Henshaw	Fine-silty, mixed, mesic Aquic Hapludalfs
Huntington	Fine-silty, mixed, mesic Fluventic Hapludolls
*Karnak	Fine, montmorillonitic, nonacid, mesic Vertic Haplaquepts
Licking	Fine, mixed, mesic Aquic Hapludalfs
Lindside	Fine-silty, mixed, mesic Fluvaquentic Eutrochrepts
Loring	Fine-silty, mixed, thermic Typic Fragiudalfs
Lowell	Fine, mixed, mesic Typic Hapludalfs
*McGary	Fine, mixed, mesic Aeric Ochraqualfs
Melvin	Fine-silty, mixed, nonacid, mesic Typic Fluvaquents
*Memphis	Fine-silty, mixed, thermic Typic Hapludalfs
Nelse	Coarse-loamy, mixed, nonacid, mesic Mollic Udifluvents
Newark	Fine-silty, mixed, nonacid, mesic Aeric Fluvaquents
Nicholson	Fine-silty, mixed, mesic Typic Fragiudalfs
Nolin	Fine-silty, mixed, mesic Dystric Fluventic Eutrochrepts
Otwell	Fine-silty, mixed, mesic Typic Fragiudalfs
Peoga	Fine-silty, mixed, mesic Typic Ochraqualfs
Saffell	Loamy-skeletal, siliceous, thermic Typic Hapludults
Wellston	Fine-silty, mixed, mesic Ultic Hapludalfs
Wheeling	Fine-loamy, mixed, mesic Ultic Hapludalfs
Zanesville	Fine-silty, mixed, mesic Typic Fragiudalfs

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